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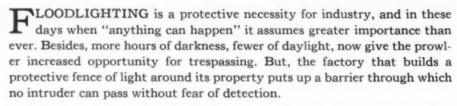
I WO I WE FAILURE



JANUARY . 1941



IT'S YOUR BIG 1941 OPPORTUNITY



So, push protective lighting-of yards and fences, storage areas, loading platforms, plant entrances-effective lighting to protect plants, to save time and money. G-E floodlights are designed to supply the proper amount and kind of light for the requirements of various locations and applications. Two of the many different types are described on the right.

To the contractor who wants his customers to have maximum protection from his next installations: Let our nearest G-E distributor or G-E office help you with a complete layout and counselling service. Your orders for floodlights will be marked "RUSH." In these days of deferred deliveries, it is well to remember that you can obtain practically immediate shipment on G-E floodlights. General Electric, Section 451-32, Schenectady, N. Y.

#### OUR PLAN TO HELP YOU SELL

Here's a direct-mail program for January and February—designed to help you sell your industrial customers more floodlighting. It is only necessary for you to do three things:

Take your telephone book and from the classified index make up a list of industrial plants in your territory. (2) Order from us, for mailing, the number of copies you need of the following material:

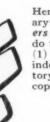
GEA-3050 Bulletin on 300- to 1000-

watt floodlights

GEA-3440 Bulletin on the three types of protective floodlighting REPRINTS of G-E advertisement in "Fac-

These will be sent to you free (while our supply lasts) along with a suggested letter to your prospects. (3) Make your mailing for increased profits.

G-E advertisement in January FACTORY to promote use of protective lighting in industry. Similar G-E advertising in March will be directed to construction field.





GENERAL & ELECTRIC



G-E low-priced, spun-aluminum floodlights has several beam angles from 28 to 100 degrees at variety of mounting attachments that m them suitable for most all applications. Provide with a one-piece, die-cast socket housing water-proof, slide-type door glass to protect reflector interior from rain, fog, or smoke. Cho of lamp sizes from 200 to 1500 watts.



The Type S-5, 1000/1500-watt, 18-inch incandes searchlight has a parabolic reflector of polisical aluminum or silvered glass. A spherical auxilia reflector in front of the lamp eliminates s light and builds up the beam intensity. The d centrated beam can be projected in any dir tion and used to supplement the yard or fe lighting where there is any suspicion of trout Simplified construction makes the price los less than \$145 with silvered-glass reflector pilot-house control.









N EW, smaller, better looking with years-ahead interior design (left), giving much more wiring space than other types. Available as service or range switches,—or for service and range duty, (1) with a single switch for either; also (2) with separate switches, one for service and one for range duty; (3) with or without branch lighting circuits.

UTDOOR types (right) differ from indoor only in box construction. The door, in closing, is slid upunder the "roof," which over-hangs the sides so deeply that the hardest storms stay out. Indoor and outdoor types equally easy to install.

S WITCH units of one-piece Bakelite — compact and practically indestructible. It is impossible to insert the pull-outs incorrectly. Metropolitan Device Corporation, Brooklyn, N. Y.



PULL-OUT TYPE RANGE & SERVICE SWITCHES

METROPOLITAN DEVICE CORPORATION 1250 Atlantic Avenue, Brooklyn, N. Y.

Send information on pull-out type switches, as well as catalog of Murray Switches.

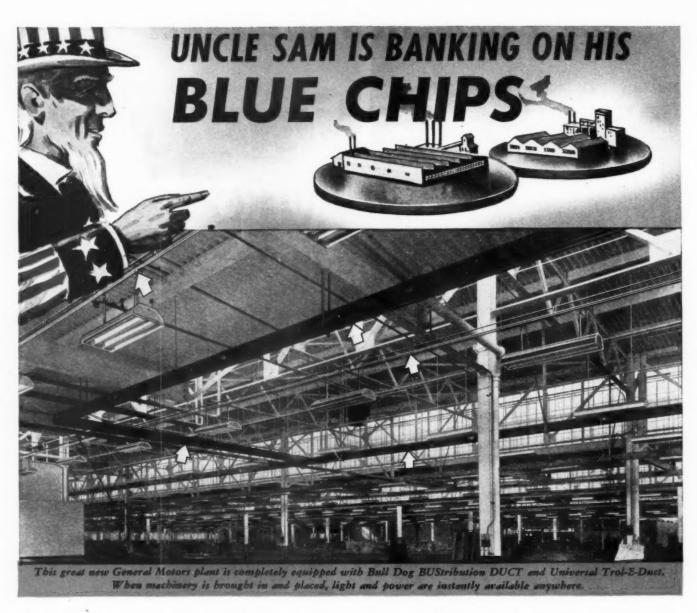
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#### The Blue Chip producers in defense production are users of Bull Dog flexible light and power systems

Fast production is the battle cry today! And if you look inside the key plants that are producing for America's defense, you will find Bull Dog flexible light and power distribution systems on the job.

A list of the users of these Bull Dog systems is an honor roll of the nation's greatest manufacturers. This isn't just coincidence. Industry has found that Bull Dog systems—BUStribution DUCT for power, Universal Trol-E-Duct for light, and Industrial Trol-E-Duct for portable tools or moving "loads"—are an immense asset in gaining uninterrupted speed in production.

With these Bull Dog distribution systems a new plant can be built—or leased—without waiting to figure exactly where either light or power need be. Machinery can be moved in any timeand tapped right in for light or power wherever and whenever needed.

Regardless of any later re-grouping or additions of machinery, instant current is available without rewiring. Both BUStribution DUCT and Trol-E-Duct are completely salvable—thus providing means, at minimum outlay, for expansion in any form.

Write for complete illustrated bulletins on Bull Dog flexible electrical distribution systems and how they help speed up production and save money.



MANUFACTURERS of Vacu-Break Safety Switches, Panelboards, Circuit Master Panels, Switchboards, Duct Systems-FOR LIGHT AND POWER

SANGAMO

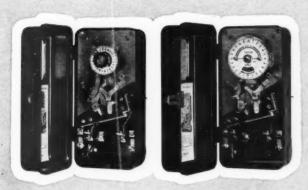
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ARE SPECIFIED AS THE CONTROL FOR FAMOUS SIGNS...





. . . YOU, TOO, CAN
DEPEND ON ACCURATE, ENDURING PERFORMANCE



FORM KA

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Time-Switches have been favorites with leading sign men—that's why famous electric spectaculars all over the country are Sangamo-equipped. Considering the strenuous service—heavier ampere loads—necessity of exceptional accuracy and unfailing performance—Sangamo Time-Switches must have earned this preference! Operating conditions are probably much less severe on your average time-switch job. You, too, certainly can expect accurate and enduring performance from a Sangamo Time-Switch.

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

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They're "Bright Spots in the Wiring Picture" — equally for home owner and Contractor. Rich, ivory-like IVORYLITE has a style-appeal so aptly in harmony with today's decorative tastes!

Structural merit backs up the style. Duplex Receptacle has full-floating contacts, adjusting automatically to alignment of the plug prongs with a firm, positive contact. Switches also have self-aligning contacts; completely enclosed Bakelite bases, compactly small for generous wiring room. Solid IVORYLITE neck and operating lever.

Switches are available in single-pole (No. 1881-I) and 3-way (No. 1883-I); listed as standard by Underwriters Laboratories; rated 10 Amps., 125V.; 5 Amps., 250 V. Plates are of standard UNILINE design with universal trade-numbers, interchangeable for all makes of devices.

The IVORYLITE Line, (brown Bakelite optional), includes Radio Outlets and multiple-gang combinations of Switches, Pilot Lights and Receptacles. All in all it's the line of today and tomorrow:... be sure you have all the data on hand for properly equipping each job; ask us to see to that!

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THE ARROW-HART & HEGEMAN ELECTRIC CO. HARTFORD, CONN.

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R EFLECTORS make a lighting fixture—particularly a Fluorescent Fixture. Fluorescent Lamps—long, low-brightness light sources—require reflectors with "punch". In Guth Fluorescent Luminaires, genuine ALZAK Reflectors provide this "punch".

Guth Reflectors are formed to engineered specifications, then finished Diffuse ALZAK in our own complete ALZAK Plant, to maintain the full diffusion of Fluorescent Light. ALZAK "Brightening" makes possible up to 25% more light output. ALZAK processing after reflector forming means a better finish. This higher reflectivity is sealed with a tough film of aluminum oxide, second in hardness only to the diamond, for life-time permanence.

ALZAK ALUMINUM REFLECTORS Sell Guth Fluorescent Fixtures with diffuse ALZAK reflectors for better satisfied customers.

Write today for New Catalog #37, featuring Guth's Complete Line of Fluorescent Fixtures. Free engineering and layout service at your command.

#### THE EDWIN F. GUTH COMPANY

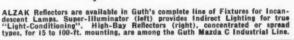
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"Leaders in Lighting Since 1902"



#### **Incandescent ALZAK Fixtures**







#### HAVE YOU A TOUGH PROBLEM?

One of the toughest is the problem of plant shut-downs and delays due to incompetent fuses. You can solve it by installing

### SHAWMUT



#### RENEWABLE FUSES

which are backed by the experience of nearly half a century in the field of circuit protection. Shawmut Shur-Lag Renewable Fuses are the simplest, sturdiest and most serviceable time-lag fuses made, and the easiest and speediest to renew.

Anything that a time-lag fuse ought to do, a Shur-Lag fuse will do; and will do with a minimum of expense and a maximum of efficiency. If you are having trouble with fuses, specify Shawmut Shur-Lag Renewable Fuses. They end tough problems, as you'll very soon discover. Or for full information, write for our Bulletin 400.





THE CHASE-SHAWMUT COMPANY NEWBURYPORT, MASSACHUSETTS

**FUSE MAKERS SINCE 1893** 

## Ever Notice How The Big Jobs Go "BUCKEYE"? 200 Tons On This One!

Your contractors have a lot at stake, you know costs must be kept down to estimates if you're going to come out with a profit. There must be a reason, then, why so many contractors use Buckeye Conduit on the big jobs.

The reason lies in the way Buckeye Conduit is made. Youngstown has the most modern equipment money can buy but -- even more important -- Youngstown also has outstanding men. In the Youngstown mills are men who have spent more than 30 years doing one thing: making conduit. It is their life work; they would consider it a reflection on their ability to pass a single length that was not as perfect as human skill can make it.

Ask your distributor for Youngstown Conduit . Pipe and Tubular Products - Sheets - Plates - Tin Plate - Bars - Rods -Wire - Nails - Tie Plates and Spikes.

26-13C



## YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon and Alloy Steels
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Buckeye Conduit going into new Sewage Disposal Plant in Detroit.

### IT'S EASY TO FIND





#### Don't fail to Send for and Use this new Catalog No. 101

Every man in the Electrical Industry—Contractors, Electrical Engineers, Utility Men and Equipment manufacturers, alike—is keenly alive to the possibilities opened up by small diameter Building Wire. But, in today's upswing of rewiring work and new construction, Thin Wall alone cannot carry the whole load.

While many men are wondering what to do, you can turn to this Roebling Building Wire Catalog and get complete data on all types of 600 volt rubber-covered wires for both new and existing buildings. Handy data for selecting insulation, wire sizes and constructions... clear, concise tables of resistances, current carrying capacities, percent of conduit fill, etc. In fact, a wealth of information that will be helpful in selecting proper wires for your jobs. If you haven't received your copy, write for it today.

JOHN A. ROEBLING'S SONS COMPANY Trenton, N. J. Branches in Principal Cities



"FORWARD MARCH WITH WIRE"

## electrical contracting

With which is consolidated The Electragist and Electrical Record Established 1901

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A SERVICE PAPER for electrical contractors, engineers, motor shops, industrial electricians and inspectors, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction—industrial, commercial, and residential.

41

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JAMES H. McGEAW, Founder and Honorary Chairman

Publication Office, 99-129 North Broadway, Albany, N. Y. Editorial and Executive Offices, 330 W. 42nd St., New York, N. Y.

JAMES H. McGraw, Jr., President; Howard Ehrlich, Executive Vice-President; Mason Britton, Vice-Chairman; B. R. Putnam, Treasurer; D. C. McGraw, Secretary; J. E. Blackburn, Jr., Director of Circulation. Branch Offices: 520 North Michigan Ave., Chicago; 68 Post St., San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta.

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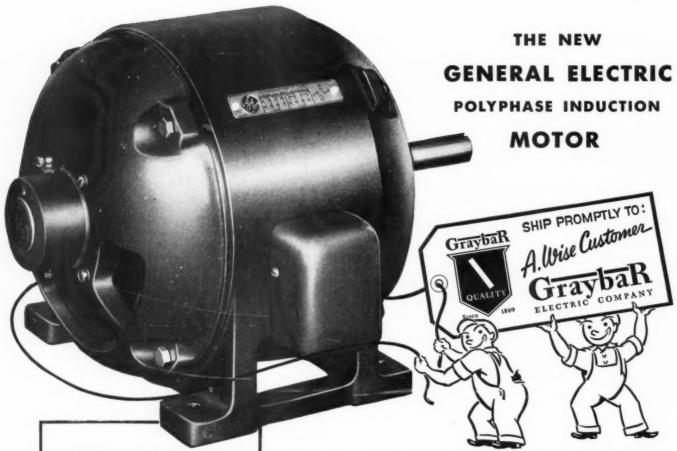
irs for

#### "What Shall I Do?"

- IN ONE OF THE MOST MOVING of the old time negro spirituals, the voice of the slave cries out "My God! Oh, my God! What Shall I do?" And except in the Americas, this is the spirit in which nearly all nations are approaching this fateful new year of 1941. How fortunate we are!
- BEYOND OUR PROTECTING OCEAN HORIZONS war rides the wind. A mad man, armed with terror, death and desolation, stalks over Europe destroying civilization. Only Britain bars his evil purpose. And behind Britain stands American industry. And we are part of American industry. We have a satisfying job on hand.
- of course, it is hard for any electrical man to see himself a factor in this vast emergency. He looks in his mirror and says—"Well, Mister, what can you do today to save the world?" He is abashed. But nevertheless we have a part to play.
- OUR DUTY, OUR RESPONSIBILITY THIS YEAR calls with no uncertainty. We do not have to ask "What shall I do?" Our path is plain. We are to help American business and industry handle war work faster, better, easier, cheaper. And if we do it well, we will prosper in the process.
- THE QUESTION IS—What does American industry need most? And what new tools have we to use this year to be of greater help?
- INDUSTRY NEEDS TWO SIMPLE THINGS. It needs better, cooler, cheaper light for night operations. And now we have the fluorescent tube to offer. Again, factories and offices need more capacity in their wiring systems. And now we have small diameter wire, ready to provide this capacity quickly and inexpensively. And we are ready to install whatever further uses of electricity they require. It is as clear cut as that.
- IN A WORD, THIS 1941 YEAR IS ALL SET to be good to us. But we cannot wait for the work to come a-clamoring. We must go out and seek it. We must carry our knowledge where it can be used. For these men of industry and business need us and do not know it. They also ask themselves—"What shall I do?"

Swe to ha time

### LET GraybaR TAG YOU A TRI/CLAD!



#### HERE'S WHAT YOU GET in the new G-E TRI-CLAD

#### 1 EXTRA PROTECTION... against physical damage

The sturdy, cast-iron frame, and endshields with no openings above the center line, protect the vital parts against physical damage. There's no chance for falling materials or dripping liquids to get inside.

#### 2 EXTRA PROTECTION... against electrical breakdown

The new stator windings of FORMEX\* wire, together with improved insulating materials and methods, give extra protection against electrical breakdown.

#### 3 EXTRA PROTECTION ... against operating wear and tear

Fundamental improvements in bearing design give extra protection against failure or excessive wear in service. A scientifically improved lubricating system and double-end ventilation augment this protection.

1,  $1\frac{1}{2}$ , 2, 3 hp. sizes now available, others soon ready.

\*FORMEX-Reg. U. S. Pat. Off.

Whenever a basic advance in electrical products is made, you can count on Graybar to be among the first to "tag" the benefits for wise buyers. Such is the case with General Electric's completely new "Tri-Clad" motor...designed to give extra protection three ways, along with higher operating efficiency and sleek, modern styling.

General Electric Motors and Motor Controls are typical of the "front-rank" lines of electrical equipment and supplies offered by Graybar throughout its nationwide distribution network in 86 cities. Yet, in each community, the local Graybar office is pledged to personal service, with individual attention to the needs of near-by buyers.

Thus, there's a double reason for going to GRAYBAR for "everything electrical": (1) The newest and best products, (2) from a "one-call" local source whose primary responsibility is keeping your good-will. Whatever your electrical needs, why not put them up to your local GRAYBAR Representative? Or, write direct for information or assistance.

Graybar Building, N. Y. C.

Graybar

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SINCE

Fig. 9

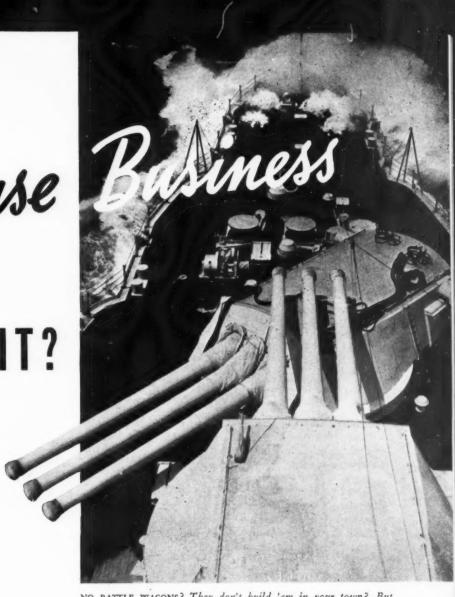
OUALITY

## Defense

...WHERE IS IT?

#### By Earl Whitehorne

Because it has not romped right in and kissed them with a glad cry, some electrical contractors are out of patience with the Preparedness Program. But make no mistake. It is real and you can have your part of it. Here is a bit of a check-up showing where the business is, who is getting it and why—and what you can expect.



NO BATTLE WAGONS? They don't build 'em in your town? But the ship yards buy steel, copper, wood, plastics, textiles, chemicals, and everything else that goes into the most elaborate electrical, air, steam, water and plumbing systems—some of it made by your local factories.

E ARE an enthusiastic people, we Americans. Thank God!
And probably the most optimistic group of all are we electrical men. How can we help it?

For fifty years this industry of ours has been growing, expanding, speeding up. More light, motors, furnaces in more factories—more light, power and ventilation in more commercial buildings—more houses wired and more appliances developed to use in them. Year by year our opportunity has been bigger, broader, better.

Why even during the past decade of bad times, when building has been stalled and all construction trades have suffered, the electrical contractor has been lucky. For after a slight drop at the beginning, the total volume of electric power used in the country has increased year by year and strung up an almost continuously progressing "all time high" from month to month. And

this was caused not alone by the fast swelling domestic use of electricity.

A large part of it was due to the effort of industry during the depression to reduce production costs, by more efficient use of electric power, control, furnaces, welding and the rest.

It is natural enough, therefore, that we should have been excited when the present National Defense movement came along and the Government Preparedness Program was launched. Here are millions—billions of cold cash to be spent on building construction and industrial production—and we sell what it takes. It looked like a rich and juicy flood of new business just landing in our laps. And it is,

But not so fast, my Brothers. Don't you know that the Government does not work that way? In June \$29;000,000 was appropriated to build cantonments, but a lot of soldier men in northern camps are still sleeping under canvas

roofs. Most of the money is to go for new industrial buildings but they are not started until the Government actually places its order with some manufacturer for war supplies. And most of that waited month after month until late fall when they got the amortization and tax controversy settled.

In brief, this giant spending program that we have heard about so long is really only just now getting into motion. And yet a lot of electrical contractors are beginning to express disappointment and complaint. "Apparently nothing is coming out of it for us!" they say.

But did they expect this Defense Business to come romping up their streets and bust through their front doors and kiss 'em on the brow with a glad cry? Unfortunately it is not that kind of a world. There must be selling even in a boom. And often times, much of the bounty comes indirectly.



NO AIRPLANES? But materials and parts for airplane manufacturers come from everywhere. They create Defense Business for every type of industry and some of these will need electrical modernization to speed production.

So much doubt and concern has been expressed, however, about what this Defense Business is really going to amount to that it seemed worthwhile to do a little checking on it. So I recently wrote a letter to a list of electrical contractors located in areas where Defense Business is apt to be felt first. I wrote to men of a type who would be apt to take an interest in the preparedness market. I heard from ninety-eight of them—everything from short notes to three and four page letters. Here's what I found out—

Twenty-five of these ninety-eight electrical contractors tell me that they already are at work on Defense Business. Here are the cities in which they are located and I set down against each city the amount of this kind of work which this individual contractor has so far received—

Boston\$200,000
Springfield 100,000
Cambridge
Albany 12,000
Newark 70,000
Passaic 75,000
Perth Amboy 500
Philadelphia 50,000
Philadelphia 120,000
Pittsburgh 400,000
Elmira
Rochester 75,000
Buffalo 50,000
Youngstownone factory
Canton 75,000
Cincinnati 25,000
Detroit "Several Thousands"
Detroit 15,000
Chicagothree factories
Minneapolis
Fayettesville 1,600
Birmingham 350,000
Phoenixfive factories
San Francisco 150,000
210000000000000000000000000000000000000

I cite these cases, merely to show that some electrical contractors are already enjoying some of this early large volume Defense Business and that it is widely distributed across the country. Other electrical contractors in these and other cities are also undoubtedly participating. But I am dealing with the evidence at hand,

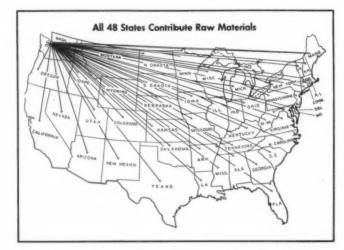
Of the balance of the ninety-eight, some have registered their qualifications with the Government and received no calls. Some have bid on jobs and lost them. Some do not want any Federal work. Some have just done nothing about it so far, but are hopeful.

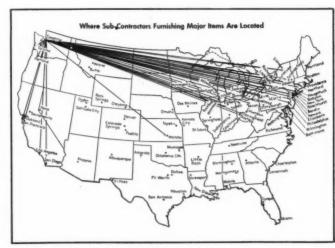
The majority of these twenty-five contractors write that they secured this business because they went after it. Also, in the majority of cases, the contracts came direct to them and not through a general contractor.

That means industrial modernization work. For most of the big Government construction projects, such as cantonments, navy yards, arsenals, air ports and mass housing, are going straight to general contractors. And here lies the most serious difficulty which the electrical contractor is encountering in seeking this kind of Defense Business. For the general contractor, being restricted to a fixed fee on the project, usually decides to do his own electrical work.

NECA has been successful in securing action by both the Army and Navy permitting the employment of specialized sub-contractors on plumbing, heating, ventilating and electrical work. But when a general contractor gets a contract it is up to him.

Electrical contractors naturally are resentful of this. They do not believe





HOW IT SPREADS—When Uncle Sam ordered 277 Flying Fortress hombers from the Boeing Aircraft Co. of Seattle, orders immediately flowed out to 536 other manufacturers for 70 kinds of raw materials, and parts and accessories.

it is in the public interest. As one ment financed buildings are but an man puts it—

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"Prior to the awarding of these contracts, practically all general contractors utilized the services of sub-contractors. Now, under the defense emergency, they set up their own departments. But they have to depend on such employees as may be secured in the open market. Whereas, if sub-contractors were used, each has his own force of specialists with years of training under severe competitive conditions, who work with speed and dispatch. If the Government desires speed and efficiency this system should be used."

Another voices the general complaint this way—

"We receive very little business through general contractors. Their practice is to put the sub-contractor through the wringer. These jobs are unprofitable, except where through established friendship the general contractor is willing to work with us and grant us a legitimate profit."

#### The Labor Problem

Others speak of the effect on labor. "Men normally available now seek overtime and higher wage scales." Industrials are buying their own material and call in the contractor to provide labor and supervision only. Or they handle the job with their plant maintenance men. And in some cities the wholesalers are promoting this idea by aggressive selling to the factories.

Several men urge that the IBEW Unions refuse to supply labor to general contractors and stand by the electrical contractor on whom they are dependent for regular employment in normal times. But this can hardly be expected. It is still a free country and who is to tell a general contractor he cannot establish an electrical department if he wants to? Especially when it is done in the sacred name of preparedness.

And speaking of labor, a local shortage of journeymen, already felt or impending, is reported by contractors from—

1.	Worcester	14.	Detroit
2.	Beverly	15.	Aurora
3.	Fall River	16.	Kokomo
4.	Providence	17.	Minneapolis
5.	Philadelphia	18.	Roanoke
6.	Williamsport	19.	Atlanta
7.	Schenectady	20.	Chattanooga
	Utica	21.	Houston
9.	Elmira	22.	Phoenix

10. Buffalo 11. Youngstown 12. Canton

13. Cincinnati

The important point to remember in all this, however, is that the general contractor is involved in only a part of the Defense Business. For Govern-

23. Fresno

25. Portland

24. San Francisco

ment financed buildings are but an early and preparatory part of the Preparedness Program. For example, here are the latest figures I have seen from the National Defense Advisory Commission, showing what this money will be spent for and where, as so far contracted for—

#### Allocation of Defense Business

Ship Construction	\$3,231,792,000
Airplanes, Engines, etc	1,502,454,000
Ordnance & Ammunition	1,237,945,000
All Other Manufacturing	804,869,000
General Construction	839,590,000

Total .....\$7,616,650,000

#### Distribution of Defense Business

New England States	\$1.322.478.000
Middle Atlantic	
South Atlantic	1,171,197,000
North Central	1,013,699,000
South Central	332,655,000
Pacific Mountain	1,396,760,000
Outside the U.S.A	79,493,000
Unassigned	

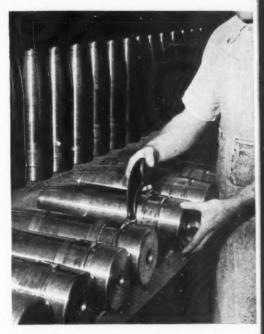
Total .....\$7,616,650,000

So glittering as all these figures may be, the Government building of arsenals, navy yards, air ports and so on totals only \$839,590,000 out of the \$7,616,650,000 of contracts awarded. The bulk of this Defense Business is therefore something else. Though two billion dollars has been allotted to construction, it will still be but a small part of the total preparedness expenditure before the money is all spent over the next two to four years.

Most of it will go to manufacturers of munitions and supplies who are our customers. They will spend it for materials and labor and buildings and equipment everywhere. And they will buy their material and parts from many other manufacturers—everywhere, And these are our customers.

The extent to which this business will be scattered is shown by a recent study made by Business Week. It is illustrated by the maps on the other page. In this case, the Government placed a \$70,499,955.20 order with the Boeing Aircraft Company of Seattle for 277 of their "Flying Fortress" bombers. Boeing immediately placed orders with 536 other manufacturers for 70 raw materials and many parts and accessories, ranging all the way from abrasives to peanut oil, from copper to cotton, from glass to sponges, from instrument jewels to talc.

The bulk of this business went to 18 (Continued on Page 104)



SHELLS AND MUNITIONS will be in the making everywhere and to aid the workers more power, more control, more space will be needed. We have a big job to do right down the production and inspection line.

A JOB FOR LIGHT — Everywhere throughout industry is the pressing need for light to help with the precision work that must be done in making fuses, engines, shell mechanisms and all the rest. It calls to us in every city.



### Inspection For Defense

NATIONAL DEFENSE gives the inspector added responsibilities. James Galbraith, bead of Detroit's department, urges intelligent cooperation with industry and common sense application of the Code.

THE foremost problem facing the electrical inspector today is the one facing this entire nation. He must fit his thinking and his daily work into the national defense program. And, although it is not generally realized, the electrical inspector has an important part to play and a vital responsibility in this great task.

Right now the most urgent part of the national defense lies in the enlargement and speeding up of industrial activity. Plants are being expanded, production schedules advanced, three shifts a day are starting and the wheels of industry are already turning continuously at a high speed. And when the wheels of industry turn, electricity turns them. Under the impetus of vastly increased production, the electrical inspector's task is not an easy one. But his responsibilities are plain. The electrical inspector must see that those wheels turn safely and yet he must not put an unnecessary barrier in the way of efficient and quick production. Now is the time when inspectors everywhere must exercise keen practical judgment.

Today, as never before, we need good

By James Galbraith, Chief Electrical Inspector, Detroit, Michigan

As inspection chief in one of the nation's greatest industrial cities, at the hub of the national defense program, James Galbraith speaks from daily contacts with inspection problems on national defense activities.

inspectors, the kind who use common sense in the application of the Code, who know when to be lenient and when to be firm. For an inspector can be so technically minded that by insisting on trivial details he can do great harm in hindering the preliminary construction and wiring that must come before the national defense production can get into high gear. Yet, there are some inspectors who are so lax that they allow conditions to exist which can do as much damage potentially as any spy or saboteur.

In inspecting industrial work in defense industries involving new buildings, rewiring in present plants or in routine reinspection, the electrical inspector today is up against some new problems. He has a great personal responsibility because, in rejecting a borderline job, he may be holding up vital defense production. On the other hand, in passing a borderline job he may be permitting serious hazards which will result in a breakdown at some more critical time.

#### Temporary Permits

In Detroit we have had experience with requests for approval on temporary installations in connection with national defense industries. The inspector must use his judgment as to whether the temporary installation is reasonably safe and in accord with the Code. Much depends upon the type of supervision and skilled maintenance the temporary installation will receive. This department cooperates by issuing temporary permits approving the job for a period of 30 or 60 days.

On reinspection work the inspector must look beyond the immediate job of Code compliance and provisions for electrical safety. He must recognize conditions which may result in crippling overloads if logical plant expansion is carried out without provisions for added loads. For instance, a

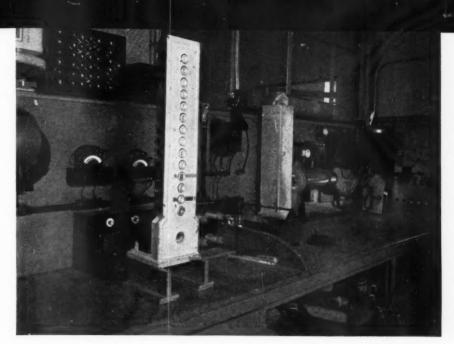
sub-feeder may be strategically located where logical expansion will require more capacity, yet is already loaded near the safe capacity limit. Or, as another example, a lighting installation designed for supplementing daylight may serve a part of the plant where orders will require shift work. Larger lamps will be installed and the whole system may fail.

It is the inspector's responsibility to bring these conditions tactfully before the contractor or the plant maintenance staff. This is particularly important in the smaller plants where the electrical inspector is likely to be the only trained electrical man to examine the system since the original wiring installation was made.

Although exceptional precautions against spies and saboteurs are being observed by plants with defense contracts, up to the present we have had no trouble in the Detroit department about getting inspectors into the job. Our men carry official credentials. They visit the job just as the wiring is completed and usually before production routine is under way. Consequently, our work is usually done before rigid rules bar the doors.

It is possible that the future will bring more severe regulations and an entry plan may eventually have to be worked out. This will probably include special defense plant credentials for a limited number of the men in our department.

In a common objective with the rest of the nation, inspectors must be ready and willing to lend every aid possible to get and keep the wheels of defense industries going. It will take many "special permissions" for the changes in wiring methods that will inevitably develop. It will take firmness to prevent dangerous conditions created by pressing production demands. But most of all, it will take sound common sense and intelligent cooperation.



### MAINTAINING a BIG BRIDGE

Toll equipment and lighting requires constant inspection, testing and maintenance. It is only possible when the staff is supported with adequate shop facilities.

By C. E. Porath

Chief Electrician, Golden Gate Bridge, San Francisco

BESIDES a multiplicity of other routine and construction jobs, the maintenance crew of Golden Gate Bridge, San Francisco, has two routine duties that are continuous. These are the maintenance and upkeep of the complicated toll recording and collecting equipment and the upkeep of the sodium vapor street lighting equipment. A test room has been equipped with facilities to duplicate the conditions under which each of these operate so that they can be given a test before being put back on the job.

Since the toll equipment is the only one of its kind west of Chicago, the electricians worked under a handicap at first, learning the eccentricities of the equipment and suffering from lack of spare parts, most of which are made especially for this particular job and not standard. Daily records of the collectors must be checked against the mechanical recording by the equipment. A weekly testing routine must be made of all boxes where the different types of toll are registered, the light signal re-

lays, the overhead and fare indicator panels and the registers themselves. Also the relays for the treadle counters and the counters themselves are taken out and put on a test rack as are the time stamp and impulse units.

Each rectox unit with its transformers and reactances are periodically adjusted after testing to make allowance for aging and variated loads. Oiling, spring adjustments, contact cleaning and adjustments, are all checked. At first treadles were sent to the factory for test and repair but now these rubberencased treadles are taken apart and tools have been developed for testing them in the shop at the bridge. In the test shop, equipment was developed that duplicates the equipment in the register room and the booth. They can each be removed from the line so that test counters, time units, interlocking treadle relays, coils, contactors, key boxes, collectors' key identifiers, overhead indicators and treadle action can all be tested against balance of equipment.

At first sodium lamps were changed

TEST EQUIPMENT—It duplicates every functional operation of the toll recording and collecting devices. And also equipment for testing of every part of the sodium lighting equipment.

hot in daylight but loss of lamp life from switching and the cost of electricity while changing forced a different procedure. Burnouts are now checked at night and the next day the fixture is checked. It may need a film cutout, new timing relay or a lamp. In the shop a test rack has been built that gives 6.6 amp. connected to a relay panel. Here the lamp is checked. The men are now trained so that they can almost tell when a lamp needs replacing. However, each lamp is checked. Timing relays are likewise tested and no lamp is changed without replacing both the film cutout and the timing relay. Since using this procedure lamp life has averaged much higher. One lamp burned out at 7,477 hours and many go over 5,000 hours. The guarantee for 2,000 hours is exceeded in almost all cases. Each lamp is numbered and a separate card kept for each fixture on which the performance of the lamp and all of the equipment is tabulated.

Corrosive effect of salt air upon the aluminum reflector has been watched very closely at Golden Gate Bridge. The luminaires are cleaned about every four months. At first they were cleaned with Alzak cleaner which took about a half hour each. Much pitting, however, was noted in them and, although new parts were furnished by the manufacturer, experiments were conducted and a new technique is now being used for cleaning and preservation.

Each reflector was cleaned, defective parts replaced and the entire fixture given a cleaning coat of Dupont No. 3818 dulux thinner. This was followed by a coat of Methacrylate No. RR 933 Dupont finish. Now they use merely warm water and green liquid soap.

BEHIND THE STAFF—General view of the maintenance shop at Golden Gate Bridge. Portable storage battery head lamps for the maintenance crew working inside the towers are charged at the extreme right.



## PERFORMANCE of Fluorescent Lamps

How to judge the darkening of fluorescent lamps and to maintain full lumen values, effect of voltage variation, temperature and vibration.

AMP manufacturers have always emphasized that published figures on the life performance of incandescent lamps are average values. They apply to a large group of lamps burned under accurately controlled conditions. The life of any individual lamp might be much longer or much shorter than this average figure.

The same thing applies with even greater force to fluorescent lamps. For the deterioration of an incandescent lamp is the direct result of the number of hours it has operated. But the deterioration of a fluorescent lamp results not only from the number of hours it has operated, but also from the number of times the lamps are turned on and off.

The fluorescent lamp's rated average life of 2500 hours is based on an average of four hours burning each time that the lamp is turned on. But in actual business and industrial use, lamps are usually left burning for a much longer period. Any increase in the number of times the lamp is turned on and off, however, will cause some decrease in the life. This is due to the loss of electron emission material from the small filament type electrodes at each end of the lamp.

While there is a gradual loss of this material during the normal operation of the lamp, the higher ionic bombardment of the cathodes during starting tends to cause a somewhat greater loss. Starting of the lamps becomes increasingly difficult as this emission material becomes exhausted until, usually around the 2500 hour period, the point is finally reached where the available voltage is not sufficient to start the lamp.

#### Darkening of Fluorescent Lamps

With incandescent lamps it i possible to obtain some indication of the effect of age from the darkening of the

#### By Harris Reinhardt

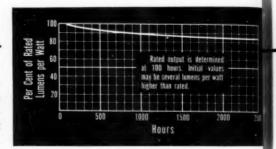
Commercial Engineering Department Hygrade Sylvania Corporation, Salem, Mass.

bulb by the deposit of tungsten particles from the filament. In examining the discoloration which occurs in fluorescent lamps, however, a distinction must be made between intense blackening, which occurs at the extreme ends of the bulb as indicated in Sketch B, and discoloration in the form of a gray band a short distance from the ends of the lamp, indicated in Sketch C.

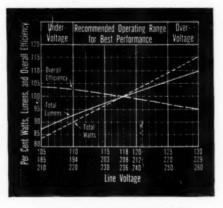
The intense blackening at the ends of the bulb directly adjacent to the base occurs late in life and corresponds to the blackening of a tungsten filament incandescent lamp. It indicates that the emissive material on the electrodes is nearly exhausted so that tungsten particles are being evaporated from it and the lamp is nearing the end of its useful life.

Also occasionally in new lamps a small amount of mercury condenses on the ends of the bulb giving it a dark appearance similar to the early stages of the type of blackening described above. But this blackening rapidly disappears as the lamp is operated and the mercury becomes vaporized. should not be confused with the blackening which occurs late in life, and in no sense should it be regarded as an indication of a defective lamp. In a similar way slight darkening due to mercury condensation may appear along the length of the lamp, particularly if it is operated in a position where one side is exposed to a draft, or, for some other reason, is cooler than the remainder of the lamp.

In rare instances discoloration bands become visible a short distance from the ends of the lamps as in Sketch B. These bands, may appear at any time after about 200 hours of operation, and



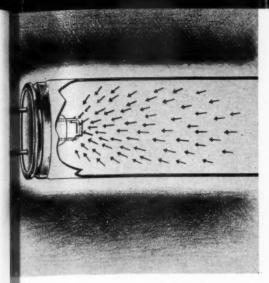
DEPRECIATION OF LIGHT OUTPUT OF A FLUORESCENT LAMP

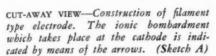


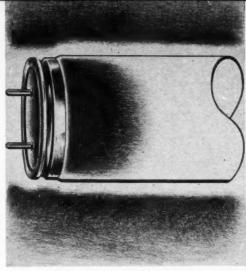
ON FLUORESCENT LAMPS

are not an indication of defective lamp performance. Since they cover only a relatively small percentage of the area of the bulb, they cause very little loss in the light output of the lamp.

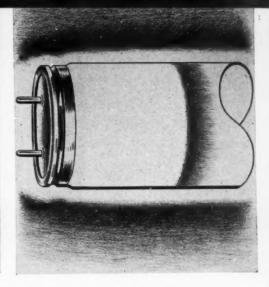
The occurrence of the bands is due to the fact that at these points inside the bulb there occurs a condensation of the mixture of coating material (being gradually emitted by the cathodes) with mercury, which is necessarily present in small quantities for the operation of the lamp. The time of their first appearance and their rate of progress depends upon many factors, both in the lamp itself and in the auxiliary equipment with which it is operated. In most cases, they do not appear at all.







SIGN OF AGE—Intense blackening at the end of the bulb occurring late in life corresponds to the blackening of a tungsten filament incandescent lamp, (Sketch B)



TEMPORARY—In rare instances discoloration bands become visible at a short distance from the base and later disappear. Not a sign of defective lamp. (Sketch C)

The depreciation in light output during the normal life of a fluorescent lamp is shown in the chart. The actual initial values, when new lamps are first placed in service, may be as much as 10 per cent greater than this. The average light output during the remaining hours of the lamp's life is approximately 90 per cent of the value at 100 hours.

#### Auxiliary Equipment and Voltage

Fluorescent lamps must be burned in conjunction with a current limiting device, or ballast, and a starter. An improperly designed ballast which permits the flow of too much or too little current through the lamp either during operation or during the starting period will result in unsatisfactory lamp performance. Ballasts supplied by reputable manufacturers should, therefore, be used in order to provide satisfactory operating conditions.

The starter is essentially a small timedelay switch which connects the ballast and the two filament type electrodes in each end of the lamp in series during a preheating period. It then opens the circuit so that the arc discharge in the lamp may be established.

The electrons produced from the emission material on the cathodes during the preheating period are an important factor in satisfactory lamp performance. If the starter is improperly timed so that there is an inadequate preheating of the electrodes, the starting will result in a drain on the electrode emission material.

Within their normal operating range fluorescent lamps are not as sensitive to voltage variations as incandescent lamps. With fluorescent lamps a one per cent change in voltage results in a change of from one to two per cent in light output. With an incandescent lamp a change of about three per cent in light output is produced by a one per cent change in voltage.

At voltages much below the normal operating range, starting of the fluorescent lamp becomes uncertain and there is a drain on the electrode material during the starting period. At voltages above the normal operating range, the active materials of the electrodes are used too rapidly. The greater current density results in the production of less ultra-violet in the range to which the fluorescent powder on the lamp is most sensitive, and the life of the lamps is also reduced. Operation within the normal operating range is thus desirable from all points of view since both over-voltage and under-voltage operations have a detrimental effect on lamp operation and lamp life.

#### Effect of Temperature

Fluorescent lamps are designed to give best performance when the surrounding temperature is in the range of 60 to 90 degrees Fahrenheit. At low temperatures the mercury in the lamp condenses out and the ultra-violet radiations from the mercury vapor are are reduced thereby reducing the light output of the lamp. At high temperatures, the pressure of the mercury vapor is increased and as a result the ultra-violet radiations shift to longer wave lengths which are not so effective in producing fluorescent action.

For an exposed lamp operating in a

location where there is no draft, there is a drop of about one per cent for each degree drop in the surrounding temperature below 60° F. This loss may be even greater if the lamps are exposed to a draft or to air circulation. If the lamps are in an enclosed fixture or built-in cavity, the effect of the change in surrounding air temperature will not be as great as with exposed lamps.

#### Effect of Vibration

The effects of vibration on fluorescent lamps are not as severe as with most types of tungsten filament incandescent lamps. But there is a limit to performance where vibration exists. Small particles of condensed mercury are often present in the lamps and the resulting motion of these particles may cause the fluorescent materials to become detached from the inside surface of the bulb producing a loss in efficiency.

Also the electrode in each end of the lamp consists of a small coiled-coil tungsten filament. It is of reasonably sturdy construction but the effects of continued vibration are to decrease the life of the electrodes, and hence of the lamps. If there is a slightly loose contact between the lamp pins and lampholder, the effects of vibration may be particularly severe as explained in the next paragraph.

It is important that the lamps be firmly seated in the lampholders as a safety measure. But also the arcing produced at a loose contact, may cause a serious loss of emission material from the electrodes. This may result in early blackening at the ends of the lamps and short lamp life.

## Vire FARMS

Rock bottom costs, salesmanship and organization make farm wiring pay a profit. A prominent Dakota contractor, from his own experience and accurate records, tells how and why.

ROFITABLE farm wiring depends on the same business fundamentals as profitable work in any part of the electrical contracting field:

1. A price that includes a margin over gross cost.

2. Low sales cost-which doesn't mean no sales cost.

3. Favorable material prices-which takes a good credit standing.

Unit price includes material and

4. Careful organization of the work

-for maximum labor productivity.

5. Trained men-for the special conditions of farm wiring work.

How much of this can the "legitimate" contractor control on farm wiring along the high-lines today? What of the future? Electrical Contracting asked me these questions. One contractor cannot answer them. But out of our experience in the farm wiring field and the experience of other contrac-

Unit price does not include

tors facing similar problems the answers may develop favorably for the electrical contracting industry.

We hold licenses in two states, North Dakota and, across the river, Minnesota. The more thickly settled farm country of Minnesota had more REA development than our own state. The bulk of our farm wiring work was done, therefore, across the line. are one of the leading electrical contractors in this area-not large by metropolitan standards of business volume-but well equipped and adequately staffed to serve our own community and our customers.

Early in 1936 the first news about REA activity started appearing in the local papers. Farmer Co-ops were being formed in Minnesota, there was a huge wiring job to be done. We went after some of these projects.

Unit Price Plan

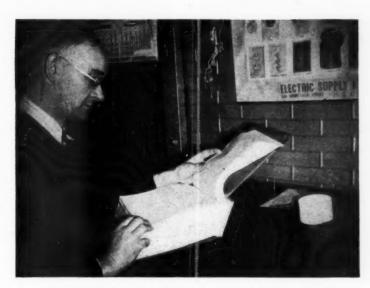
The first plan used by the Co-ops to contract for wiring was competitive bidding on blocks of farms. Fifty or one hundred farms were grouped and contractors asked to bid unit prices for the lot. The actual job conditions were unknown, the quantities were uncertain, there was no experience available to determine average costs, specifications were weak. In all, it was hopeless for the established contractor, who had to treat this type of contract like any other, to compete as a business venture in the hope of profit. Unquestionably, more of these early contracts were won by thoughtless estimating than competitive skill.

In 1938, REA introduced the established unit price method of letting work. The Co-op executives called a meeting of interested contractors with a wiring advisor from REA. Specifications were drawn up for all farms on that Co-op's lines. Then a group of unit prices for

#### STANDARD WIRING UNIT PRICES FOR MEMBERS OF LINES OF CASS COUNTY ELECTRIC COOPERATIVE, INC.

Established unit prices are adopted by Co-op officials and contractors. These from Cass County are typical. Originally figured to be very low, allowing a small profit, these prices are being cut by some contractors and chain stores.

labor for complete installation.	cost of lighting fixtures.
INSTALLATION UNITS SERVICE ENTRANCES	APPROVED W.P. SERVICE CABLE
2 wire #8 A W G with 15' cable 30 Amp fused: 3 wire #8 A W G with 15' cable 30 Amp fused: 3 wire #6 A W G with 15' cable 60 Amp fused: 3 wire #6 A W G with 15' cable 50 Amp multil (25¢ for each additional ft. of cable	-4 branch circuit
SMALL OUTBUILDING SERVICES  2 wire #10 A W G and smaller	2.65
YARD POLE METER LOOPS	
3 wire #6 A W G	
HOUSE WIRING	NON-METALLIC SHEATHED CABLE
Ceiling and side wall outlets, inside and out. Switch outlet, S.P. switch and flush type switche Switch outlet, 3 way switch and plate. Duplex receptacles and plate. Electric Range outlets with 20' cable (25¢ addi Bell transformer and bell.	s and plate
OUTBUILDING WIRING	NON-METALLIC SHEATHED CABLE
Light Outlets.  Surface type switch outlets.  Convenience outlets.  Hay mow light.  Yard light and switch, 2-3 way.  Yard light and switch S. P.  Water pump outlets.  Portable utility motor outlets I h.p. 20' cable.  Portable utility motor outlets 5 h.p. 20' cable.  Stationary motor outlets I h.p. 20' cable.  Stationary motor outlets 3 h.p. 20' cable.  Stationary motor outlets 5 h.p. 20' cable.  Stationary motor outlets 5 h.p. 20' cable.	2.00 2.00 3.70 8.35 4.20 3.70 4.20 5.25 5.25 6.80
OUTSIDE WIRING	WEATHER PROOF WIRE
No. 10 W. P. wire in place per ft.  No. 8 W. P. wire in place per ft.  No. 6 W. P. wire in place per ft.  No. 4 W. P. wire in place per ft.	



CONTRACTOR WOOD of Fargo makes individual cost analysis on farm wiring jobs, figures 5 per cent net at prevailing unit prices.

each type of outlet, service entrance, outbuilding line, etc. was worked out and agreed upon by the contractors and the Co-op officials. The unit price list was published and distributed to the farmers.

In the preparation of the unit prices a mark-up of 25 per cent on cost was used, based upon no sales work by the contractor and the handling of several jobs in a group. Co-op employees obtained the signed contract from the farmer and made a layout of the farm buildings showing the connecting lines. For these layouts and contracts the contractor paid the Co-op five per cent of the contract price to cover the cost of the survey work.

As the projects got under way, jobs were distributed to the contractors on the approved list as fast as they were requested. The project was blocked off roughly and each contractor was assigned an area depending upon his capacity and facilities. We got them in groups of 5 to 10 farms at a time.

In order to make the low units profitable, we organized two special crews of five men each. An expert electrician, a \$1.00 an hour man, headed each crew. We put on four young men for each crew at 45 to 60 cents an hour, each specially trained for one part of the work. One handled service and meter loops, another inside branch circuits, another outside lines between buildings and another exposed wiring in outbuildings. With layout, connections, and general supervision by a skilled mechanic, the crew quickly de-

veloped smooth running teamwork that gave each man limited responsibilities and a chance to develop a high degree of speed and competence in his part of the job

We made some mistakes in hiring our men. After the first 10 farms, we dropped the dead wood and reorganized our crews. From then on the jobs started to show black figures.

One thing we noticed about our competitors in the field was the amount of non-productive time they spent at the jobbers' counter. We eliminated this cost burden from our balance sheets by rigging up a rolling warehouse in a 1½ ton enclosed truck.

The interior of the truck was fixed up roughly but efficiently to store all of the tools and materials that two wiring crews would require for a full week. On nearby projects, within twenty miles of the shop, one of the boys drove it in weekly for re-stocking. For more distant projects, materials were shipped by rail to the nearest freight depot and the truck restocked there.

Material specifications in the project in this area usually require good quality. Our own standards are relatively high, because it pays. We have to live with the jobs and we must be able to guarantee them. The cost of sending a man 50 miles out to replace a defective receptacle would buy a lot of quality merchandise. We find it good business to use the better materials in the original installation.

The men eat and sleep at the farm. There is no allowance in the unit price

#### By Charles Wood

Central Service Co. Fargo, North Dakota

#### **JOB ORDER E-33**

Complete material, labor and job expense summary is prepared on each contract. These are the actual figures on one of the larger jobs. Note item for mapping service, an important cost item on rural work.

PRICE	QUAN.	MATERIAL	UNIT
.08	1"	¾ conduit	.08
2.40	15'	11/4 conduit 11/4 service head 34 service head	.16
.45	1	1/4 service head	.45
.21	i	1/2 service head	.21
2.17	7	service head	.21
1.50	15'	8-3 ent cable	.10
4.41	63'	8-2 ent cable 6-3 ent cable 10-2 lead cable	.07
2.60	20'	10-2 lead cable	.07
1.52	8	sill plates	.19
1.52 .70	35	sill plates cable straps	.02
.04	2	11/4 straps 1/2 straps 8 WP wire	.02
.03	5 1528'	1/2 straps	.001/
2.97	132	6 WP wire	.021/
.90	45'	6 bare wire	.02
2.57	79"	6 RC wire 12-14 wire	.031/
.80	80°	12-14 wire	.01
4.48	32	pole knobs 2 spool racks	.81
3.60	2 2	yard light	
3.60 2.25	50'	1/2 thinwall	1.80
.80	10	/2 thinwall /2 connectors	.98
3.60 4.30	3	ground rod with clamp	1,20 4,30
9.60	8	30 amp. 4 cir switch	1.20
3.70	ĭ	60 amp. 4 cir switch 30 amp I cir switch 60 amp WP switch	3.70
.75	5	ground wire connectors	.15
1.20	40	cable connectors	.03
4.48	32	4" clamp boxes 4" oct boxes	.14
.45 1.76	16	switch boxes	.11
.72	8	handy boxes	.09
.20	2#	cable straps	
2.86	13	single pole switches	.22
.28	2	4" boxes with covers 3-way switches	.14
.72	12	I gang plate	.08
.96 1,20	12	2 gang plate & 3 gang	.10
2.60	13	duplex recept	.20
.22	19	single recept	.11
3.03	15	plain box rec pull recept	.17
24.41	10851	14-2 romex	.024
1.49	35'	14-3 romex	.0 1/
1.86	50"	12-2 romex	.03
.80	4	rolls of tape	.20
.09	13	rawl plugs bar hangers	.10
.09	12	insulated staples	.603
.30 2.70	1	lamp guard	
2.70	3	kitchen uni:	
3.90	39	lamps	
.52	i	Condulet & plate S.P. switch	
2.75	1	30 Amp W.P. switch	
25	100'	bell wire	
.20	1	pushbutton	
.47	- 1	transformer	
1.00	2	150 W lamp	
.40	î	fixture	
1.00		Misc., screws, solder, etc. Total Mdse	
153.51		Total Mdse	
3.00		Job Expense	
24.45		Mapping Service Inspection Fee	
77.25		Labor	
5.35		Tax on Labor	
266.06		Total	
349.00		Contract price	
82.94		Profit	
4970			

schedule for this kind of job expense and the farmer expects to take care of our men when they are wiring his property. There was some agitation on one project to get the farmer to charge for room and board but we have had very good cooperation from our customers.

In the latter months of 1938 the method of allotting jobs changed. More contractors signed up for the work. The territory allotments did not work out so well. Some farmers were already signed up with other contractors when we arrived at the job. To control this condition, we sent salesmen into the territory to sign up customers and make the job layouts. We budgeted 5 per cent of the contract price for this sales work.

The unit prices held well into 1939 as the volume of work increased. After the volume flattened out and more contractors entered the field we ran into price cutting.

Every job we handled was individually recorded on cost sheets at the office. We were in close touch with every detail of job costs and the profit on each job. We knew that the low unit prices provided a narrow margin of profit under the "mass production" methods we used. It averaged out about 5 per cent net after overhead

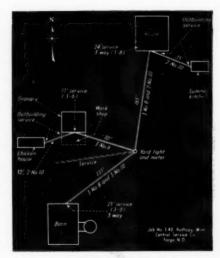
costs were deducted. Obviously, a price cut was impossible. We have consistently held our prices at the established schedule—but it was necessary to raise our sales cost to  $7\frac{1}{2}$  per cent.

If the present price competition continues, our sales cost must eventually reach 10 per cent. Our estimates indicate that this is the borderline between profit and loss in this market at prevailing unit prices.

It is important to note that even under direct competitive bidding the minimum sales cost is 5 per cent. For a salesman must see the customer, survey his job and sign him up.

Much of the cut price competition comes from individual farm wiremen. Lacking business experience, they regard all of the margin between the material cost and the contract price as profit. And operating without organization or the benefit of credit and purchasing power, they can make 50 to 60 cents an hour wages.

The most serious competition, however, is rising out of the chain stores. One well known nationwide concern is especially active. On one Co-op project they have two mechanics working and signing contracts at 20 per cent under the unit prices. At the present time, the volume of farm wiring contracts handled by this firm is



MAPPING SERVICE is part of sales cost.
The diagram shows outside work, contract forms give inside work schedule.
Five per cent of contract is allotted for sales and mapping.

not great in this area—but it is increasing very rapidly. It is safe to predict that at the present rate of increase this concern will dominate the market in this area within two years.

If we are to compete with the chain stores there must be a great reduction in material costs. Our costs on quantity purchases through the jobber are only a little less than the retail prices for job lots of equivalent materials at the chain store.

In 1939 we wired 130 farms which represented approximately 25 per cent of our total business volume. We operated at 16 per cent overhead that year and made a net profit of five per cent on the farm work. In 1940, our farm wiring volume dropped off, and with rising sales cost and chain store competition we are not hopeful about 1941 farm wiring prospects.

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In spite of this gloomy forecast electrical contractors can still control a large part of the farm wiring market—if they will work together, because—

1. We can demand fair, honest unit price schedules. The Co-op wants the "legitimate" contractor on its project, he does better work, causes less trouble, sells more outlets and handles his affairs like a business man.

**2.** We can help Co-ops set up a sales and mapping service that will avoid expensive duplication of effort. Individual contracts are too small to allow personal solicitation by several contractors for the same job.

**3.** We can impress our suppliers with the importance of granting the quantity buyer with good credit, access to prices that can compete with the chain stores.

#### COMPLETE JOB SUMMARY

Actual contract amounts and gross profit on 66 wiring jobs during 1939 and 1940. Gross averages slightly over 20 per cent on sales, overhead 16 per cent. Of these 10 were paid on REA note, 56 by cash. Collections, 25 per cent at start, 75 per cent on inspection certificate, showed a perfect record.

NO.	CONTRACT	PROFIT	NO.	CONTRACT	PROFIT
1	201,08	40.81	34	216.78	55.75
2	183.21	47.35	35	185.72	47.69
3	33.60	2.69	36	132.00	38.84
4	184.35	33.27	37	124.00	26,39
5	170.66	28.74	38	56.00	5,53
6	144,15	25.07	39	118,98	20.74
7	118.30	18.59	40	259,15	17.53
	180,37	24.13	41	189,21	54.30
9 .	34.25	2.57	42	214.30	25.79
10	153.80	34.30	43	162.24	37.28
11	62.15	9.26	44	133.78	28,73
12	162.79	30.04	45	77.75	13.69
13	247.80	46.90	46	50.55	14.74
14	181.47	27.65	47	608,85	162.19
15	275,25	73.01	48	147.23	7.30
16	106.44	19.79	49	149,93	17.97
17	154.00	16.94	50	148.23	34.12
18	121,15	17.31	51	159.85	30,52
19	138.62	27.62	52	152.30	42.6
20	165.88	34.70	53	115.00	31.69
21	189.90	68.75	54	. 123.35	31.5
22	175.30	22.28	55	158,25	44.7
23	281.00	58,00	56	145.70	32.20
24	155.35	3.00	57	158.45	34.3
25	164.45	37.40	58	210.00	36.13
26	230.33	67.01	59	33.00	4.7
27	81.46	8.29	60	76.40	12,3
28	150.00	39.41	61	128.75	25.8
29	167.94	31,43	62	87.55	14.6
30	264.60	70.62	63	155.00	29.7
31	103.50	19.84	64	134.60	28.9
32	149.00	10.53	65	52,33	8.2
33	349.12	83.06	66	202.05	52.3

Electrical Contracting, January 1941



Before Unitrol

a milestone of engineering progress in MOTOR CONTROL

New **Unit** Construction... standardized and flexible... brings the desired advantages of centralized Motor Control within the reach of any budget. A custom - built control center . . . at an installed cost less than that of any "home-made" substitute.

Unitrol is a new idea in Motor Control. It is a new unit-type of standardized Motor Control construction which permits all needed types of control devices to be easily organized into a complete enclosed sectionalized Motor Control Center...making it just as big or just as small as your present needs require. It is easily, quickly and economically built up, without special engineering, containing just the individual controllers, disconnect switches, and accessories you specify.

Unitrol comes to you complete ... either with all wiring, busses, terminals and interconnections already made...or with provisions for wiring it "on the job". It may be changed, extended, or contracted later on, just as easily and economically as it was first built up. It saves space, time, trouble, worry, and inconvenience up and down the line; and its installed cost is less than the cost of any "home-made" substitute.

#### 1st ... The Unitrol Unit



The basic element of Unitrol is a simple unit mounting-frame into which any standard control device may be bolted. This unit frame has integral with it a hinged cover or door which may be blank, or arranged for either dead-front manual or push-button operation of the device enclosed.

2nd ... The Unitrol Section

#### The Unitral Section is a steel enclosure which houses and supports a group of Unitrol Units. It is constructed of standardized interchangeable members to form the sides, top and back . . . with unique provisions for bus supports,

wiring troughs, conduit or duct entrances, etc.



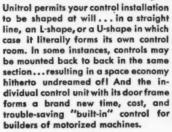
#### 3rd...The Unitrol Control Center

A Unitrol Control Center consists of a grouping of Unitrol Sections fabricated into a complete sectionalized assembly and delivered ready for installation and use



SECTIONALIZED CONTROL

Unitrol...Fits control to the job





Write for this book . . . A new bo "Unitrol . . . the next step forward in Motor Control," tells the whole important story. Sent free by request on your business letterhead. Write for your copy today. CUTLER-HAMMER, Inc., Pioneer Electrical Manufacturers, 1306 St. Paul Avenue, Milwaukee, Wisconsin.

After Unitrol



THE MODERN Copyright 1940—Cutler-Hamme



Earl Whitehorne, Editor

#### Labor Shortage Ahead

There can be little doubt that labor shortage is soon to be a very real problem for the electrical contractor. Reports from many communities show trouble ahead. Other towns see it as imminent. Washington is becoming concerned over the impending pinch in the building trades.

The labor unions are naturally slow to admit the conditions, hoping to find work for all their members, incompetent and over aged included. But the fact will have to be faced. For you cannot quit training apprentices during a decade of bad times and be ready for bumper business.

In face of this prospect, every electrical contractor will naturally do everything he can to strengthen his status with his good men, to build the organization spirit of his gang. But this is purely defensive. The industry must face the further fact that new men must be provided for the heavy years that lie ahead. Adequate measures toward apprentice training should be taken at once on an organized basis of cooperation between the industry and labor.

#### There It Is!

A recent survey showed that about 33 per cent of industrial plants expect to buy motors within the next six months. Some 49 per cent say they may "possibly." Only 18 per cent do not expect to.

The average plant among these covered, buys 25 motors a year, with an average value of \$5,061. The average electrical contractor who does industrial work sells 55 motors a year, with an average total value of \$6,924. He serves 112 factory customers. The

average motor shop sells 80 new motors a year averaging \$7,902 in total value. They serve 130 industrial customers.

What does it all mean—such figures? Just another sidelight on this industrial market that waits in every city. We are so used to having these familiar factories all around us. It's so easy to forget to sell them. But if you want more of this business there it is

#### **Fixture Wiring**

The fixture manufacturers do not all agree. That is natural enough. In November we ran an item here quoting one of them who wondered why the contractor does not buy unwired fixtures and wire them himself inasmuch as he is in that business. But others say no.

The point is, and it is a good one, that the finish of modern fixtures requires careful handling by mechanics who are softer fingered than a contractor's wireman. The testing of fixtures for grounds is also involved and the labeling service of the Underwriters Laboratory. So there are two sides to this, as with most other things, and the contractor's policy will depend protty largely on the extent of his fixture business and the way the relative costs work out.

#### Knew Your Men

Added to our regular responsibilities now comes the danger of sabotage. It is a very present hazard today. Both the FBI and the Dies Committee have given us sufficient evidence to make it so.

We cannot afford to introduce

people into factories unless we are sure of them and of their work. We must accept responsibility for their moral character as well as their mechanical skill. And we must plan their work with an active thought for protection as well as production.

It is something we have not had to bother about in the past. But from now, until the whole emergency is past, it is a duty that cannot be shirked.

#### Wide Horizons

"North Dakota is where you look further and see less than any other place in the world." So said Charlie Wood, of Fargo, in opening the Fall meeting of their state association recently. But it did not impress the visitor that way. Watch the electrical contractors in this broad, flat land and you see plenty.

Not only have they a license law and state-wide inspection, well operated, but the individual contractors are progressive and alert. The discussion reflected advanced ideas in wiring, in lighting, in selling, in management.

Big city contractors could well be proud of such enterprise. Dakota's wide horizons are more than geographic.

#### We Are Responsible For Fluorescent Confusion

Manufacturers, wholesalers, contractors worry because the public will buy anybody's junk when fluorescent lighting is offered. Why should they not? The new tube is interesting, colorful, new—the fad. And how should the average citizen know good from bad?

It is the fault of electrical men and the fault can be easily corrected. Power companies, wholesalers and contractors should unite in every city, aided by their manufacturers, to warn the public to buy from responsible local people who can install and service these new units as lighting—not as a decorative novelty. It won't take long to get the idea over.

#### Waste Of Materials

Practical measures to conserve materials should be seriously considered by the electrical construction industry.

The government is calling for an amount of equipment that staggers the imagination. One project, for example, calls for 625,000 miles of signal cable, carrying 65 wires. And it all must come out of the same factories that supply the needs of the regular mar-

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If we all do the work that will be called for, as American industry begins to modernize and expand, we should seek every way to avoid destroying old equipment and scrapping old material that can be utilized economically in a reorganized wiring system. We can get more capacity into old conduit by the use of small diameter wire, for instance. We should take advantage of higher voltages and every other device for giving a factory its increased capacity without waste.

#### **Full Services** Or None

Factories needing new feeders, motor circuits and other electrical modernization are calling in contractors. Their own maintenance people are too busy with increased production to do this work. But in many cases the management insists on buying the materials themselves. In a word, they want to take advantage of the contractors selected labor but buy labor

The answer to that should be-Our business is to sell "No!" materials, equipment and labor, plus knowledge, experience, organization and specialized management. should sell it on each job or not take the job. It will be hard to do at times but the issue should be faced-or your independence and your prestige

-Back Talk-

#### **Buying Unwired Fixtures**

To the Editor—"In your November issue, on page 26, there is an editorial item entitled 'Buy Unwired Fixtures.' The writer of this article is not aware of the impractical aspects of what is proposed and recommended.
"I Bu law in many cottes the week of the commended."

recommended.

"1. By law in many states throughout the country, Underwriters Laboratories' labels are required to be attached to fixtures sold. It is impossible to secure these labels unless the fixtures are wired at the factory.

"2. I do not believe the second paragraph of this article is correct for, as

stated, it implies that the manufacturer and distributor make a profit on the wiring. Anyone attempting to wire fixtures without proper equipment would go to considerably more expense than it can be done at the factory where fixtures can be wired more economically on a mass basis.

"3. Further, it also would be necessary for a manufacturer to duplicate all his catalogue numbers and stock by carrying both wired and unwired. This, of course, would be impractical and impossible.

"We take exception to the article for the above reasons as the writer apparently does not have an understanding of the problems which his recommendations involve."

R. L. Davis

R. L. Davis American Lighting Equipment Association, Inc. New York, N. Y.

Thank you Mr. Davis, for broadening the viewpoint. The original suggestion came from a fixture manufacturer. We raised the point. Your three statements are interesting. We would, of course, assume that the cost of wiring would be in the price. The matter of the labels is highly important. Of course, the cataloging feature is a serious consideration.

#### More Knowledge Needed

To the Editor—"I enjoyed your article 'Romance Goin' Wrong' and think it is just about one hundred per cent correct. If the contractor, salesman and jobber could be made to believe in and understand fluorescent lighting as an art in the lighting industry, and, if they would try to do a first class job and stop worrying about a dollar or two more in cost of the equipment we could really go to town with this fluorescent lighting.

"I find that the main trouble with the whole set-up is that the men who sell and install fluorescent lighting do not know enough about it. They will not take the time to try to learn what it is all about."

L. M. Seely
Greenway Reflector Mfg. Co. Philadelphia, Pa.

Fluorescent lighting calls for a lot of study, re-education of the contractor and the lighting salesman. It is slow in coming but we believe it will come. It has broadened the whole subject to where our knowledge must be more highly organized. The contractor will gradually recognize this and face it, we believe. Thanks for your comment.

#### Inspection

To the Editor—"I read with a great deal of interest your November editorial entitled 'Our Turn, A Bit'. Would that we were able to get this message over to the 10,000 contractors who really and truly want statewide inspection and a sound apprentice system.

We have been working for the past 10 years in this state for statewide inspection. But we find that it is the apartment house and hotel associations who have opposed it.

All we have to do is to wake method.

it.

All we have to do is to wake up the sound asleep contractors and impart to them the message that it is now their turn because the electrical contracting industry, holds now just as great an opportunity as it did 50 years ago. Let us have more editorials such as this one."

W. W. Ingalls, Pres.

The Ingalls Electric Co.

Miami, Fla

Thank you, Bob—You are sound in your confidence in this business of ours. It can be as big and as profitable as we make it—when we make it. And some day these 10,000 contractors will begin to work together to this end. We will see it.

#### Fluorescent Facts

To the Editor—"Seldom has an editorial impressed me so deeply as hitting the nail squarely on the head as did yours in the October issue of Electrical Contracting. I agree heartily with every sentence. This editorial coupled with your case studies in

good lighting practice should make this issue of *Electrical Contracting* extremely valuable to all wholesalers engaged in the legitimate distribution of fluorescent lighting equipment and who think of such equipment as legitimate merchandise."

C. E. Kirkpatrick Manager Lamp and Lighting Dept. Graybar Electric Co., Inc. San Francisco, Calif.

Thank you Mr. Kirkpatrick for your strong endorsement, We're glad you agree with our analysis of the fluorescent situa-

#### Statewide Inspection

To the Editor—"Your editorial on 'Our eration of every electrical contractor in the country today. We stand ready to do our bit to make a reality—state-wide inspection, contractors' licenses and a sound apprentice system. Come on Contractors, let's go!"

Joseph Tomasulo Joseph J. Tomasulo & Co. Roselle Park, N. J.

Atta Boy! That is the spirit we need more of among electrical contractors, Mr. Tomasulo. Because we do a local job too many of us are local minded. We forget that after all we are one breed of cats and that some of the most important things must be done nationally—all working together. Let's keep after these three till we start action.

#### That Better Name for 3-Way Switch

To the Editor—"I believe whoever sold the first three-way switch to a Spanish speaking customer found the answer to your request for a new name to describe such a useful device. Being a good salesman, determined to create a clear understanding in his prospect's mind of the device he was offering and its practical application, he not only translated the empty English name but rather substituted it by words meaning 'Stairway Switch.'

"This name immediately brings to mind the idea of turning on a stairway light downstairs and then turning it off upstairs, which is the primary function of such a switch. Once this idea is clear to the layman he can easily realize that a stairway switch is used to control a light or group of lights from any two points. Now overdoing things, you might call a four-way switch a "Three Story Stairway Switch' but remember you asked for it in your October editorials."

Julio Jaucken. Gant
Privada Juarez-Hidalgo No. 2
Torreon, Coahuila, Mexico

This sounds like an excellent solution. For though all 3-way switches are not used on stairways, it is the typical application and illustrates the purpose and idea. Who has a better one?

#### Plenty to Sell

To the Editor—"I never miss reading Electrical Contracting and your editorials. I too, sometimes wonder what is the matter with contractors. They don't seem to know that a suggestion will sell them a job. Just look around and see what is missing and there is plenty to do.

"To my way of thinking every house needs more electrical work, every house is unfinished electrically. Think that one over. May I list some? Let's start at the front door—door chimes, outdoor receptaces, hall three-way. There are too many to mention. I feel that you certainly have hit the mark with your writings."

W. Edwin Dodge Dodge Electric Manhasset, N. Y.

Yes! Opportunities for more volume surround us on every side, more equipment to suggest that the customer does not order because he does not think of it. The trouble is that neither do we—too often. But we can and should. Thanks for the kind words.



#### BOX SHELVES

George J. Martin & Son, electrical contractors at Albany, N. Y., use a simple and inexpensive method of storing wiring accessories.

The shelves in the stockroom consist of wood boxes all made the same size—28-inches wide, 13-inches high and 16-



EASY REARRANGEMENT is a feature of these shelves constructed of uniform boxes. Another tier is just added if more storage space is needed.

inches deep. The bottom side of each box is made of  $\frac{7}{8}$ -inch material to carry the weight of the contents. The boxes are stacked side by side and back to back, three, four and five high depending upon the amount of storage space required. They can be arranged in aisle formation, along a wall or any method desired.

Ease of portability and re-arrangement are features which make this an ideal system for the average shop.

#### WEDGED LUGS

On a new feeder installation in a Chicago office building, the Garden City Engineering Company employed a hydraulic lug indenter to attach over 300 lugs.

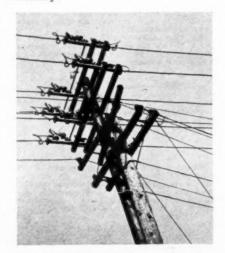
The tool has fitted heads to take each size of lug. The cable insulation is peeled back and the end inserted into an ordinary solder type lug. The

hydraulic tool drives a deep dent into the back of the lug under great pressure "flowing" the metal of the wire and lug permanently together.

#### SECTIONALIZING POLE DISCONNECTS

In a recent plant modernization project the E. J. White Company, electrical contractors of Newark, N. J., installed a high tension inter-plant pole line distribution system, complete with pole operated disconnect switches. These were installed to sectionalize the feeders and tie-in with the plant generators and local utility lines in case of an emergency.

The disconnects used were of the single pole type and rated at 400 amperes, 7500 volts. They were mounted on double cross arms on the top of a 45-foot pole. Each group of three switches were mechanically connected by a horizontal tie rod which, in turn was connected by a lever arm to a vertical rod mounted on the pole. This permitted a person on the ground to open or close the disconnects when necessary.



POLE OPERATED disconnect switches are used to sectionalize and tie-in the overhead distribution system with the plant generators and utility lines. Operating rod has not yet been installed on this group of disconnects.

The new poles with the disconnects were set adjacent to the existing poles and when the complete changeover was made the old poles were removed.

#### SPLASH-PROOF MACHINE LIGHTING

The Garden Electric Co., Elizabeth, N. J., installed standard RLM reflectors over machines in a nut and bolt manufacturing plant. These units were used where a wide area of the machine was to be highly illuminated for critical seeing tasks.

On machines where there was a possibility of oil spattering and splashing, a clear glass cover was mounted on the reflector to permit easy maintenance of the fixture. Thus, if cover became smeared with oil, the operator merely wiped it with a cloth and in a few



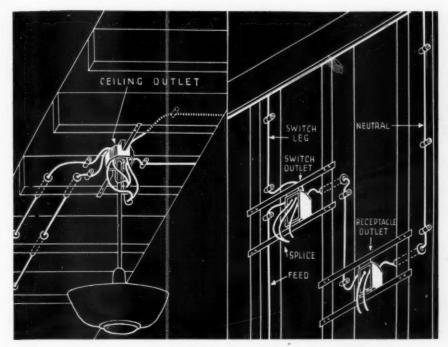
MACHINE LIGHTS with clear glass covers solved the oil splashing problem on the cutting machines in this nut and bolt plant.

seconds he again had clear bright light. In this particular plant the electrical system was 120/208-volt, three phase, 4-wire and the machine lights were mounted on the same conduit feeding the motors and were connected to the neutral and one outside leg of the system. Compactness and simplified wiring resulted.

#### INSTRUMENT TROUBLE SHOOTING

A quick method of locating shorts and grounds on wiring systems is used by the Dudrey Electric Company of Moorhead, Minnesota.

The fuses of the offending circuit are removed and, using a radio test set as a low resistance ohm meter, the resistance of the shorted circuit is measured. Plugging into each receptacle or fixture socket the trouble shooter traces down the point where the resistance is lowest. If the fault lies in the wiring between two outlets the meter readings from each is proportioned to the length of



Porcelain Protected Wiring Systems Finding Wide Acceptance in Residential, Commercial and Industrial Fields. Here is What Goes Into the Job.

Modern Porcelain Protected Wiring Systems represent an advancement in the science of electrical wiring that can be likened to the new technique of replacing narrow roads with modern separated double lane highways. They provide, for modern wiring, the double lane safety that is required for modern electrical loads.

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The Porcelain Protected Wiring System is based on the principle of employing for insulation and support the two best insulating mediums known—these are dry air and porcelain. Another basic principle is the elimination of extraneous conducting elements unless they are absolutely required for protection in areas where severe mechanical hazards exist. Conductors are supported in free air on porcelain supports and in porce-

lain tubes through building members, for maximum insulation protection and safety.

At points of control and utilization, porcelain outlet boxes and cover devices eliminate the objections found in boxes of conducting materials. They are shock proof, short proof, rust proof and corrosion proof. Standard knockouts and standard spacing in porcelain outlet boxes take all modern fixures, switches, convenience outlet and cover devices. No clamps, connectors, or special adapters are required.

The Porcelain Protected System is the only wiring method that provides full circuit insulation and isolation without being dependent upon conductor insulation. ductors could be bare, although it is not recommended, because all conductors are supported in free air on porcelain. Also because all conductors are supported in free air, the entire system operates at a lower temperature and the 1940 National Electrical Code (Table II Appendix) permits greater carrying capacities, for all conductor sizes, as compared to other wiring methods. This differential in carrying capacity starts at about 33% on No. 14 wire and increases to more than 100% on the larger size conduc-

In Porcelain Protected wiring, as in other modern wiring procedure, number 12 wire must be used as a minimum for appliance circuits to kitchen, dining room and laundry. Number 12 wire is also recommended as a minimum for all circuits feeding convenience receptacles. Conductor sizes for other circuits, and feeders, will depend upon the load they are to carry and the permissible voltage loss. A generous allowance for future load increases should be made so that the occupancy may retain its electrical modernity over a greater period of time.

ADVERTISEMENT

## Modern Porcelain Protected Wiring System

#### Newest Scientific Accomplishment

The latest types of wire with improved insulation are used in Porcelain Protected systems. The contractor may choose the most efficient type for each job through the proper selection of conductor sizes and types of insulation. Type R, RP, RH, and RHT conductors may be used in this wiring method.



Electrical porcelain materials for Modern Porcelain Protected Wiring Systems are manufactured by









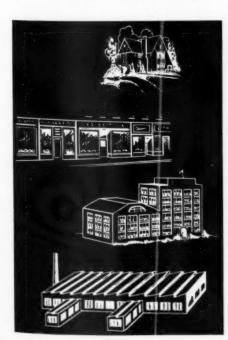


Illinois Electric Porcelain Company, Macomb, Ill.

> Knox Porceiain Corporation, Knoxville, Tenn.

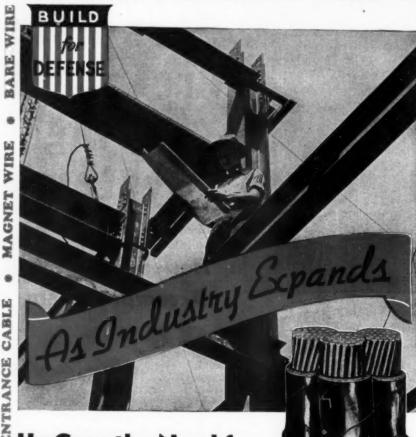
Porcelain Products, Incorporated, Findlay, Ohio

and may be obtained through your electrical wholesaler.



Electrical Contracting, January 1941

RUBBER COVERED POWER CABLES . BUILDING WIRE



Up Goes the Need for CRESCENT

CABLES

- RUBBER POWER CABLE
- VARNISHED CAMBRIC CABLE
- SIGNAL CABLES
- CONTROL CABLES
- BUILDING WIRE and CABLE



CRESCENT RE and CABLE

Factory: TRENTON, N. J. - Stocks in Principal Cities

CRESCENT ENDURITE SUPER - AGING INSULATION



[FROM PAGE 28]

the cable between. In practice this method has located a short within two feet on a 15 foot run.

The instrument used, they say, must be sensitive to small differences in resistance but high accuracy is not essential as the actual resistance of the circuit is unimportant.

The same instrument is used to test electric range elements with the range disconnected. The test terminals are connected to the range plug and the readings noted as the switches are op-erated. Open, shorted, or grounded units can be discovered in a few seconds without risking the fuses.

#### SUSPENDED PIPE TRESTLE

CABLE

FLEXIBLE

CORDS

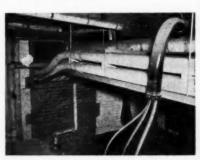
ENCASED

AND

PARKWAY

CABLES

To install the main feeders from a power company transformer vault to the main switchboard in an existing building, the Vanderlinde Electric Corp., Rochester, N. Y., had to find a way of suspending them overhead and still clear all existing pipe lines and air ducts. The feeders consisted of eight 4-inch transite ducts, running in a double tier for about one-third of the 210-foot length and in a single tier for the rest of the way.



CONTINUOUS FRAMEWORK supports these transite feeder ducts. Con-structed of angle iron, the frame is sus-pended by bolt rod at various elevations to clear existing pipes and ducts.

The mounting problem was solved by constructing a continuous angle iron trestle suspended from the ceiling by bolt rod. Angle iron spacers were installed on the under side of the framework at each suspension point. Short flat iron straps were bolted to the angle iron at the joints to make them rigid. Suspension heights varied along the run to allow for existing pipe and air duct clearances. The sides of the framework were continuous along all these points where the elevation varied Where the ducts were installed in a double tier, conduit spacers were used.

ENTRANCE CABLE

SERVICE

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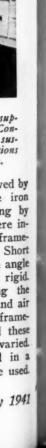
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#### LIGHTING A COCKTAIL BAR

There are a number of attributes which cocktail bars should possess, namely (1) the light on the patron may be soft and subdued, conducive



BOTTLED GOODS are provided with a sparkling attractiveness when lighted from below through luminous glass shelves with dark backgrounds.



SUBDUED LIGHT for the patrons and plenty of bright background lighting for the bar blend to produce a genial and restful atmosphere.

to an atmosphere of geniality and leisure, (2) the general background area of the bar at the same time should be as bright and inviting as possible, and (3) the bottles and glassware should sparkle and stand out in

all their attractiveness of form and transparence. The lighting suggestion shown incorporates these basic considerations. It will be noted that luminous shelves with dark backgrounds are incorporated in the design. It has been found that due to the special light reflecting and light refracting qualities of glass, the smooth contour and clarity of glass objects stand out to best advantage when lighted from below. A dark colored background is necessary because the flow of light up into the glassware is delicate, and a light background would tend to nullify these highlights, which, as the illustration shows, are most intriguing.

#### BENCH, ASSEMBLY AND INSPECTION

Bench work, assembly and inspection operations require a high level of good quality illumination which, in general, can best be supplied by equipments of



the large-area, low-brightness type. Where a high degree of diffusion is not required the Glassteel diffuser, the RLM dome reflectors equipped with white bowl lamps, or the deep bowl porcelain enameled reflectors will produce the desired result.

Each job requires analysis to meet specific requirements. In some instances dual facilities must be provided, (1) diffuse lighting for certain defects, (2) directional lighting producing "glint" which may be essential to reveal others.

#### NEW IDEA IN SIGN DESIGN

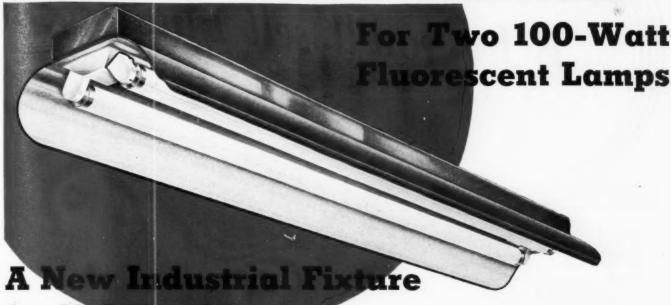
Schmanke's Boot Shop in Rochester, New York, incorporates a silhouette sign which employs silvered bowl lamps to achieve a pleasing effect. The transom element is 30 inches deep and 28 inches high. The 100-watt silvered bowl lamps are on Pittsburgh strip spaced 30 inches apart, 22 inches from



WEAVE ROOM LIGHTING in this southern textile mill at Drayton Mills, S. C., is provided by 180 two lamp 100-watt fluorescent units, each of which contains two 40-watt daylight lamps. The units are spaced on 8-ft. by 8-ft. centers and mounted approximately 9-feet from the floor. One unit is placed over each loom at right angles to the loom harness. The critical seeing tasks of the loom operators are now made easy by the 30 foot-candles of practically shadowless illumination on the working plane.

NEW! Lay Brite

### "SUPER TWO-HUNDRED"



for lighting larger areas requiring higher intensities

Again Day-Brite pioneers a radical improvement in fluorescent lighting. This time with Day-Brite "Super Two-Hundred"... the sensational new Day-Brite development for lighting large industrial areas where higher intensities of soft, cool, glareless light are necessary. Think of the features Day-Brite "Super Two-Hundred" offers...

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- 1. It's built for two 100-watt fluorescent lamps.
- It delivers up to 50 foot-candles of soft, cool, glareless light to the working surface, the exact quantity depending upon spacing, arrangement and mounting height.
- Its Tulamp ballast provides high power-factor and practically eliminates flicker.
- 4. Its porcelain-enameled reflector — white inside and gray outside — can be wiped

clean in a jiffy with a quick whisk of a damp cloth.

- Thanks to its hinged reflector, installation is remarkably quick and easy.
- It's built by an organization of lighting specialists with a 20-year record for top-quality lighting fixtures, advanced design and sound engineering.

The Day-Brite "Super Two-Hundred" is the fluorescent lighting unit wanted in large industrial concerns in your area... and you are the man to sell it. Every Day-Brite sale you make pays you both immediate and future profits, because Day-Brite quality leads to repeat business from happy, satisfied customers.



#### Send for Bulletin F-45

This Bulletin contains just the information you need to make sales—complete data on specifications and prices—everything you and your customers want to know. Should be worth many an extra dollar to you — sent free on request. Write for it — NOW!

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5432 Bulwer Avenue

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All Leading Electrical Wholesalers Sell and Recommend Day-Brite Fluorescent Lighting

## Why you'll sell Fluorescent



Fluorescent in FLEUR-O-LIERS means greater display opportunities—easier seeing for customers—more sales. FLEUR-O-LIERS are certified for satisfactory service.

High level lighting in sturdy FLEUR-O-LIERS brings safer, faster, more accurate seeing to industry.

Some of the Certified\* FLEUR-O-LIERS now available in a wide range of prices and designs. Consult your lighting company for advice on how to get the most out of fluorescent lighting.

## lighting faster....

### Certified\* FLEUR-O-LIERS

Certified FLEUR-0-LIERS for 1941 continue to give you one of the greatest selling opportunities you've ever had! Stores, offices and factories everywhere are installing fluorescent in FLEUR-O-LIERS, because these smart, sturdy fixtures give them this amazing new light source at its finest... certified, balanced lighting performance.

Over 40 leading manufacturers make FLEUR-O-LIERS. These fixtures are tested and certified by impartial Electrical Testing Laboratories to over 50 exacting specifications set up by the MAZDA lamp manufacturers for good light—safe, reliable service. More than 85 commercial and industrial Certified\* FLEUR-O-LIERS are now available in a wide range of prices and designs—and there are more on the way!

Strong, consistent national advertising in Newsweek and 15 trade and business publications backs you up—helps you sell. We're telling your customers the value of certified fixtures—the meaning of the familiar FLEUR-O-LIER label. It's time to cash in. Use the coupon below for complete information, including a list of FLEUR-O-LIER manufacturers.

that FLEUR-O-LIERS have met with 5 specifications for Lighting Effectiveness—6 for Electrical Safety—18 for Mechanical Soundness—14 for Electrical Excellence ... as set up by MAZDA Lamp manufacturers. All Certified\* FLEUR-O-LIERS must be equipped with auxiliaries (ballasts and starters) certified by E. T. L.

#### FLEUR-O-LIER

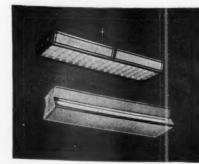
Manufacturers

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer whose product complies with FLEUR-O-LIER standards

#### LET THIS LABEL GO TO WORK FOR YOU!

- It assures high quality fixtures and satisfactory performance for your customers.
- 2 It means fixtures certified by Electrical Testing Laboratories to specifications set up by the MAZDA lamp manufacturers.
- 3 It means fixtures that use control equipment (ballasts and starters) which are certified for balanced performance.
- 4 It means fixtures backed up by strong national advertising, which helps you sell faster.





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Please send me helpful information about Certified FLEUR-O-LIERS, packages of indoor daylight for stores ☐ offices ☐ factories ☐

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Address

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State

WIRING REQUIREMENTS CAN BE MET QUICKLY... CONVENIENTLY... EFFICIENTLY with

## LATROBE FLOOR BOXES and WIRING SPECIALTIES

No matter how exacting are the requirements of a wiring job, LATROBE products are able to "fill the bill"— quickly, economically and efficiently. For, every floor box and wiring specialty manufactured by LATROBE is designed and built incorporating certain predetermined performance features. One is safety . . . in essence, this is the backbone of adequate wiring! You'll find that there are few lines of electrical wiring products so admirably equipped to provide safe, sure wiring wherever installed. A second feature is performance plus flexibility. Once installed, a LATROBE floor box is sure to give long lived service, yet provide means for wiring changes that may be brought about by future power revamping.

Another important characteristic is LATROBE's time saving quality . . . each product saves countless hours in installation time by eliminating the opening of the floor. Take these plus benefits as a unit, and you see why Latrobe products are in a position to fill every requirement. They're suited for residential, commercial and industrial use.

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NO. 284 DUPLEX RECEP-TACLE NOZZLE

Compact and neat. Available with 1/2" or 3/4" brass pipe extension. Also Latrobe Duplex Telephone Nozzles.



NO. 138 ADJUSTABLE WATERTIGHT FLOOR BOX

Cutaway view shows No. 130 Box with No. 207 Bell Nozzle. Cover plate  $3\frac{1}{2}$ " — overall height  $3\frac{1}{2}$ ".



NO. 330 LATROBE TOM THUMB UTILITY OUTLET

For use in wood installations and other locations free from moisture or mechanical injury.



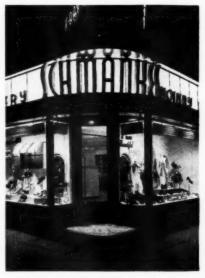
NO. 476 PIPE OR CONDUIT

Pipe support turns freely, allowing pipe to run parallel or at right angles to beam. Eliminates drilling or straps. Takes ½" to 1" pipe to beams ¾" thick. The
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LATROBE, PENNA.



[FROM PAGE 32]

the Mississippi Belvite Softex glass which covers the cavity. The cavity is painted with a flat white paint to insure good diffusion. The letters are free standing, 28 inches high, with the face and depth of the stroke both 4 inches. The faces are beige and the



GLASS COVERED cavity illuminates this silhouette sign 20 produce an attractive storefront

sides maroon, thus harmonizing with the structural glass on the storefront. The letters stand out 2 inches from the cover glass of the lamp channel. This new method of lighting a silhouette sign was conceived by the Lighting Service Department of the Rochester Gas and Electric Corporation.



A path of light aids the traveler in going to and coming from trains entering the Los Angeles Passenger Terminal. Holophane equipment is used. The units are recessed in the ceiling 11-feet above the floor and spaced 15-by 20-feet apart. Two hundred watt lamps provide 7 foot-candles.



#### Just Between Us

There are about fifty of us advertisers assembled in this issue of the magazine.

Each one of us scans the pages to learn what the others are saying to induce you contractors to buy.

A FEW of us manufacturers are firmly convinced that you contractors yourselves are far better off when you buy your electrical supplies through our Wholesale Distributors.

Better off?

32]

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Who extends credit to the thousands of electrical contractors in this country, and frequently makes it possible for them to carry on their business?

And, by the same token, who saves contractors the costs of warehousing? And the delivery of supplies to the job? And provides up-to-date product, catalog and price information—to mention but few services?

The Wholesale Distributor, of course.

We, the Thomas & Betts Company, believe so strongly in the economies and services rendered by Wholesalers that we rely solely upon them for the distribution and sale of our products.

We publish a Distributor discount schedule, and discounts to all Distributors are in exact accordance with those published schedules. There are no exceptions.

This is part of The T & B Plan, under which we operate for the benefit of the contractors, the wholesalers — and ourselves alike. And this is our advertisement.

#### THE THOMAS AND BETTS CO., INC.

TB

MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899

Factory, Engineering and Executive Offices, Elizabeth, N. J. • Sales and Service offices in 23 leading cities

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## Maximum Results

YOU CAN EXPECT LIGHT to play an even more important part in improving employee efficiency, increasing accuracy of inspection operations, reducing fatigue and minimizing accidents when you install Benjamin Fluorescent Lighting. Because Benjamin Fluorescent Lighting makes it practical both from the standpoint of cost and seeing to use MORE LIGHT in plants, offices and other commercial locations.

You not only get this EXTRALIGHT economically but you get a new kind



of light which permits the use of MORE LIGHT without excessive brightness or annoying glare—a light

that promotes the speed and increases the ease of seeing.

You Get a COLD LIGHT (75% less radiant heat) that enables you to mount lighting units close to the work area ... that makes it ideal for air conditioned locations.

You get DAYLIGHT Lighting that is not only more effective but more economical for operations involving close checking of form and color, fine assembly work and inspection operations. You get lighting that makes work places cool, comfortable and attractive in appearance...that blends well with natural light... that insures uniform lighting day and night.

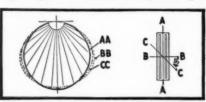
#### YOU CAN EXPECT Fluorescent Lighting that is Engineered to Your Specific Seeing Requirements . . .

Benjamin Engineers have designed Fluorescent Lighting Units to meet the individualized

demands of thousandsofworkplaces. Whatever your lighting requirements...you will

find a Benjamin Fluorescent Lighting Unit engineered for your specific need.

#### YOU CAN EXPECT Fluorescent Lighting Units that are Designed Right



Every Benjamin Fluorescent Lighting Unit is certified by Benjamin to embody the most approved principles of lighting reflector design...to provide the highest light output commensurate with seeing ease . . . to provide adequate light cut-offs for minimizing glare . . . and to embody the Benjamin design principles developed through years of leadership in industrial and utilitarian lighting.

### YOU CAN EXPECT Low Operating Costs, Low Maintenance Costs and Long Life . . .

Every Benjamin Fluorescent Lighting Unit is built to the nationally known Benjamin standards for quality and

durability. They incorporate many exclusive features of design and construction which reduce



operating and maintenance costs and and insure longer life. They are certified by Benjamin to conform with all of the requirements of the Underwriters' Laboratories, and to comply with highest safety requirements, illumination, electrical and mechanical standards. They are easy to install...include special provisions for quick, easy relamping and servicing, and special devices to protect the life of lamps and circuits.

#### FREE DATA BULLETINS

BRING YOU the Complete Story of BENJAMIN FLUORESCENT LIGHTING

You may secure new Benjamin Data Bulletins on all types of lighting in which you are interested from your Electrical Wholesaler, your local Electrical Contractor, or the Benjamin Field and Engineering Organization. Or mail the coupon below. The Benjamin Electric Mfg. Co., Dept. H., Des Plaines, Illinois. All Benjamin Lighting Equipment is Distributed Exclusively Through Electrical Wholesalers.

BENJAMIN ELECTRIC Dept. H, Des Plaines	
Gentlemen: Please send me I	Data Bulletins on:
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## FLUORESCENT UNITS

#### NOW! A BENJAMIN Engineered for Store, Office and Other Commercial Use. The New Benjamin FLUR-O-LITE

This new unit marks a new advance in Fluorescent Lighting for commercial use. Outstanding features include: RIBBED GLASS PANELS which directs rays outward increasing the spread of light upon ceiling: DIFFUSING PLASTIC PANELS, which cut down lamp brightness; GREATER ACCESSIBILITY, EXCEPTIONAL EFFICIENCY, OUTSTANDING BEAUTY OF DESIGN. Send coupon for data bulletin.

#### BENJAMIN RLM "STREAM-FLO" WITH NEW BENJAMIN LOUVERS AND TWIN STEM CANOPY SUSPENSION

These new louvers improve appearance and provide additional shielding so that lamps are hidden at most angles of vision. They increase shielding angles to 23 degrees on all sides of the reflector, yet due to their careful design, light loss by interference is minimized. The new Canopy Suspension, illustrated with this unit, provides an efficient and attractive means of suspending Benjamin "Stream-Flo's" in offices and locations where improved appearance is desirable.

### BENJAMIN RLM "STREAM-FLO" NOW AVAILABLE FOR BOTH 48" and NEW 60" FLUORESCENT LAMPS

This new unit has 14 degree shielding angle, reflection factor 79% or more and light output efficiency of 75% or more. Both the 48 Benjamin "Stream-Flo" and high power factor auxiliaries which minimize flicker. They carry the RLM Label indicating conformance to all RLM Specifications.



#### STEEL BAND ARMATURE SLING

To facilitate the handling of large, heavy and cumbersome armatures, the Phoenix Electric Co., motor repair shop in Youngstown, Ohio made a steel band armature sling. It is constructed of two layers of thin (approximately No. 24 gauge) sheet steel about four feet long and 11-inches wide. The two ends of the sling are bent around one side of triangular handles made of round bolt stock and welded at the



STEEL SLING for handling heavy armatures with short shafts is a big time and labor saver in this motor shop.

joining point. Two pieces of flat iron and stove bolts securely fasten the sling to the handles.

This sling takes armatures up to 18 inches in diameter and is especially handy for moving locomotive motor armatures having no extended shaft around which the conventional rope sling can be used.

#### INSULATION TAPE EDGER

The Electric Motor Repair Co., Trenton, N. J., has installed a new gadget that puts a reenforcing edging of scotch electrical tape on the paper slot insulation. This tape is applied



SCOTCH TAPE EDGER is used to apply a protective edging of scotch electrical tape to slot insulation.

to keep the insulation from tearing when the coils are being placed in the slots.

The machine holds a roll of %-in. scotch electrical tape. This tape is fed between two rollers through a guide groove. A turn of the handle operates the rollers which feed the insulation and at the same time edge it with the reenforcing tape, about \(\frac{1}{4}\)-inch on each side. A small thumb blade cuts the tape when the end of the insulated paper is reached.

The edger clamps to any table and can be used wherever it is most convenient. In this shop it is located in the coil room.

#### PORTABLE DIPPING TANK

Motor dipping operations at the Electrical Engineering and Service, Inc., shop at Westfield, Mass., are performed in portable steel dipping tanks.

Two tanks are used, the large one measuring 28-in, by 42-in, by 33-in, high and the small one 24-in, by 24-in, by 30-in, high. Both tanks are fitted with casters and with fire-stop covers. This fire-stop feature is accomplished by the use of an angle iron flange welded to the outer sides at the top of the tank. The steel cover which is hinged to the rear flange has an angle iron frame which fits snugly inside of the tank. The out-



PORTABLE TANKS with fire-stop covers save steps and needless handling and reduce hazards of dipping operations.

side lip of the cover fits snugly over the outer edge of the tank flange. So, if the dipping compound becomes ignited the cover is closed and prevents the oxygen of the air from entering the tank and the flames are smothered.

The use of these tanks eliminates the necessity of moving heavy motors to the dipping tank then back to the baking oven. Here the tanks are rolled in front of the oven, the motor which is attached to the oven hoist is dipped and then rolled into the oven. They are also a big help in keeping the dipping and baking room clean.

#### HAND COIL WINDER

E. J. Wood of Danbury, Conn., finds a hand operated coil winder very helpful in his motor repair shop. So he built himself an adjustable one consist-



HAND WINDER has numerous adjustments for winding 36 different sized coils. Requires only one minute to set up for making any particular coil. It can easily be adapted to motor drive.

## These are but a few of the fine Leviton



wiring items produced by Leviton for residential, commercial and industrial work. You will find them all good profit makers . . . your end of their up-to-the-minute design and manufacture in Leviton's modern plant.

Have you seen Leviton's latest devices? Ask your wholesaler to show them to you. Or, if more convenient, drop us a line, and we will gladly send a sample and complete details on any item you may wish.

All types of Fluorescent fixture devices—push in type—sturdy construction and easily mount-ed. Can be mounted with either 2 screws or with I screw as

CAT. NO. 381



CAT. NO. 380



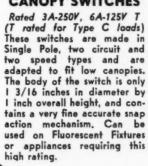
CAT. NO. 720



CAT. NO. 572



#### PULL CHAIN CANOPY SWITCHES





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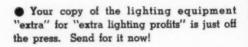
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## THE LIGHTING EQUIPMENT Profit-Book

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And it's YOURS For the asking!

New
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CATALOG
NO. 40



- You'll be mighty glad to have a copy of the new Permaflector Lighting Catalog No. 40 because it gives you the answers to your lighting problems—quick as a wink! Every page is chock-full of useful lighting data and presents important information on new Permaflector sales-building lighting equipment simply, concisely and completely in a new, different way—designed for quick, accurate selection and ordering.
- No groping for information in this catalog
   —it's all at your finger tips. An important
  factor in these days of working against time
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PITTSBURGH REFLECTOR CO.

403 OLIVER BUILDING PITTSBURGH, PENNA.



[FROM PAGE 401

ing of a large steel plate with each quarter section drilled full of holes to accommodate brass pins which determine the shape of the coil to be wound. These are held in position by nuts which can be either the conventional or wing type.

The two pins that form the nose of the coil are easily adjusted. They ride in a slot in the center of the plate and operate parallel to its length. They are adjusted by two long threaded bolts. Turning the bolts in one direction moves the pins toward the edge of the winding plate; turning the bolts in the opposite direction causes the pins to move closer to the center of the plate.

The winder shaft is bearing mounted in a T pipe fitting which, in turn is supported by a length of pipe fastened to the workbench by a floor flange. The operating handle on the other end of the shaft is also adjustable to give more or less leverage as required by the particular job at hand. The entire mechanism can be converted to a motor driven piece of apparatus, if so desired, by removing the handle and keying a pulley to the shaft.

With the number of adjustments available Mr. Wood is able to make 36 different sizes of coils ranging from a hairpin coil to a fully shaped one. It takes about one minute to adjust the winding head to make a coil of a partic-

ular size.



MORE HAT'S mean more business for Emmett J. Wood of E. J. Wood & Co., electrical contractors and motor shop men of Danbury, Conn. Practically all of bis industrial contracting and motor work comes from Danbury's famous hat industry, hence his boost for more chapeaux. Here, he is in the process of rewinding a 20 hp. motor for a hat former.



## We combined 500 man-years with 62 years

TRI/CLAD

is work
and were

The New

GENERAL DELECTRIC

POLYPHASE INDUCTION MOTOR

1,  $1\frac{1}{2}$ , 2, and 3 hp. Larger sizes later

BUILT FOR PROTECTION FIRS

## of RESEARCH of motor EXPERIENCE



HE Tri-Clad motor is all new-and it's built to industry's own specifications. Five years of asking questions among motor users in all types of industry and studying industrial processes told us what you want in a general-purpose motor-what you want in styling-in convenience and adaptability—in extra protection on the job. At the same time, through its research and engineering organizations General Electric was developing new and unique materials, such as insulations based on synthetic resins; new manufacturing processes, such as the "booking" method of casting; and new ways of getting the most out of the active material in a motor, such as controlled annealing. Out of these new ways of doing things came the ability to build the triple-tough motor you asked for.

We call this new motor "Tri-Clad" because extra protection has been built into it in three basic ways:

1. The sturdy, cast-iron frame and end shields with no openings above the

center line protect the vital parts against physical damage. There's no chance for falling materials or dripping liquids to get inside.

- The new motor windings of Formex\* wire, together with improved insulating materials and methods, give extra protection against electrical breakdown.
- Fundamental improvements in bearing design give extra protection against failure or excessive wear in service. A scientifically improved lubricating system and double-end ventilation augment this protection.

Here's a test: Recall every point of weakness that has ever cropped up in a general-purpose motor to cost you money. Then check them against the features listed on the next page. Don't stop with protection; consider the characteristics, the convenience features, the sleek styling—even the paint job and the name-plate. We'll rest our

case for Tri-Clad on how close it then comes to your ideas of what a truly modern motor ought to be. \*Reg. U.S. Pat. Off.



TURN PAGE INSIDE



- One-piece, cast-iron frame and rigid cast-iron end shields protect the motor against external blows and accidental abuse.
- Enclosed construction protects against entry of falling objects and dripping liquids; keeps chips and the like from vital motor parts.
- Low-velocity, double-end ventilating system provided by fans cast integrally with rotor winding keeps the motor running cool and prolongs insulation life.
- New winding methods give shorter end turns, reduce the number of internal connections, and improve characteristics.
- Mounting features adding to convenience include reversible stator and four-position end shields.

- Synthetic-resin insulating varnish, with exceptional bonding strength and high resistance to heat, bonds the conductors together and prevents movement of the windings.
- Steel-shell bearing linings of hardtin-babbitt are of fundamentally new design and have a new method of grooving which provides positive lubrication for either direction of rotation.
- New and simple ball-bearing mounting assures correct alignment and exclusion of foreign materials. Easily cleaned and regreased by means of the G-E pressure-relief system.
- Big, roomy, four-direction conduit box is quickly removed from its base to give unrestricted working space for making connections. Flexible leads are clearly marked.

- Formex wire—the toughest magnet wire yet developed—assures a continuous dielectric film under the most severe conditions. Formex is highly resistant to abrasion, moisture, varnish solvents, and heat aging.
- End windings are coated with Glyptal No. 1201 red, providing a tough, hard finish that is highly resistant to heat, moisture, oil, and abrasion.
- One-piece cast-aluminum rotor winding with fans cast integrally is practically indestructible, has no joints, and gives a cool-running low-inertia rotor.
- All laminations, both in stator and rotor, are annealed for low iron losses and uniform characteristics.
   Special rotor treatment improves operating characteristics.

General Electric Company, Schenectady, N. Y.

GENERAL BELECTRIC

## maustrial fication MAINTENANCE

#### MEETING SEVERE SERVICE CONDITIONS

Pertaining to the Protection of

**Electrical Equipment** 

FTEN operations not originally planned or scheduled, or complete changes in operations and processes, will require electric apparatus and devices to function under severe conditions. It may be excessive dust, increased humidity, high ambient temperature, exposure to falling objects, use of flammable material or something else.

Where such service conditions cannot be changed, counteracting by good maintenance is necessary. as an aid for the plant electrical maintenance man, or an electrical contractor performing the same duties, this discussion presents ways to meet various severe service conditions for specific electric equipment. How to eliminate causes of severe service conditions will be discussed in a following issue.

#### Ventilation

An apparatus or device is safely ventilated only when it is provided with a means to permit circulation of air sufficient to remove excess of heat, fumes, or vapors. Increased air circulation that may be needed may be obtained for individual equipment by placing a fan or blower directed at the unit. Vaults housing transformers, disconnect switches, and circuit breakers, for example, should be provided with ex-

haust ventilators so that the equipment can carry its load without operating in still air.

Where operations have changed and dust and fumes have become excessive, the first step is to exhaust these elements. Of greater importance is the protection of the electric equipment, by (1) locating it in a separate room, (2) using dust-tight or water-tight equipment, or (3) housing the electric apparatus with individual enclosures. Such

DUST PROBLEM-A dust-tight lighting fixture is shown at the right. A totally enclosed, fan-cooled motor drives this dust extractor in General Food Corp.'s corn mill at Kankakee, Ill.



#### ABNORMAL SERVICE

THE use of electrical equipment under abnormal operating conditions is prevalent in many industrial plants today, due to the reclamation of plants idle for some time and increased pressure of heavy production schedules. In many cases complete process changes were made, introducing elements which formerly did not exist: such as excessive moisture exist; such as excessive moisture or dust, increased temperature and humidity, use of hazardous raw ma-terials, increased loads on production machinery and continuous op-eration on night and day shifts. Now, what has all this to do with

Now, what has all this to do with the maintenance man? It simply means that on his shoulders falls the responsibility of keeping the production machinery operating even under the severest of service conditions. If they cannot be alleviated, he must fortify against them. It means an unrelenting maintenance schedule covering frequent tenance schedule covering frequent and systematic cleaning and test-ing of the electrical equipment and thorough check up to determine if the proper type is being used for the specific operating condition. It means adapting present equipment to the task at hand. It means that the maintenance man or electrical contractor must know

what to do and how to do it.

To aid these men, this article discusses ways of meeting severe service conditions. How to prevent these conditions will be the subject of a later article.

Previous articles covered-

- 1. Simplifying Electrical Maintenance
- 2. Preventive Maintenance of Distribution Systems
- 3. Preventive Maintenance of Electrical Equipment
- 4. Reducing Power Costs
- 5. Maintaining Good Power Fac-tor-Part I
- 6. Maintaining Good Power Fac-tor-Part II
- 7. Meeting Severe Service Conditions (this issue)

Future articles will discuss-

- B. Eliminating Causes of Severe Service Conditions
- 9. Safety Protection for Electrical **Operations**
- 10. Increasing Flexibility of Electrical Service
- 11. Providing Adequate Capacity for Increased Demand
- 12. Extending Automatic Control
- 13. Electrifying Operations to Reduce Unit Costs
- 14. Methods for Handling Change-overs and Live Circuits

enclosures should have clean air supplied through a duct and maintained at slightly higher pressure within the enclosure than outside to prevent entrance of dust and other elements.

Where the dust and vapors developed are of a hazardous nature, ventilation alone is not adequate. Measures must be taken for protection in hazardous locations. This is treated in another

part of this discussion.

To provide ventilation for wiring either open or concealed, or horizontal or vertical runs, the conductors and conduit should be spaced to allow for adequate air circulation between adjacent runs. This applies particularly to runs near radiators, along walls adjacent to furnaces and kilns, in tunnels containing steam pipes. Cabinets and enclosing cases will have better ventilation and be less affected by moisture forming on a wall or heat conducted through a wall, if washers are used on the mounting bolts to keep the enclosure away from the wall.

#### **Dust Removal**

Dust if allowed to accumulate, may cause excessive wear of moving parts, overheating, a short-circuit, a ground, and possibly a fire or an explosion. So obviously, electrical apparatus and devices must be cleaned regularly. Hand brushing or blowing out equipment are common methods of cleaning. cleaning should be done where the equipment, treated and adjacent, will not be affected when the stirred-up dust settles again.

Compressed air should be dry and have a gage pressure not exceeding 30 lb. per sq. in. Even at this pressure it will sometimes lodge instead of remove particles in crevices and blow off insulation. An industrial vacuum cleaner is preferable for cleaning because dust is not scattered but actually removed and collected. Also, metal and abrasive particles are loosened and removed.

When the amount of dust increases, bare lamps and other open type equipment must be cleaned more often. Accumulation of dust must be avoided on open wiring, conduit, and enclosing cases of control so that the entire surface will have unaffected ventilation,

particularly the top.

For ordinary use, motor starters and other control devices should have enclosing cases so constructed that dust will not enter. This is the dust-tight type. The dust-proof type is to be used where an accumulation of dust will not interfere with its successful operation.

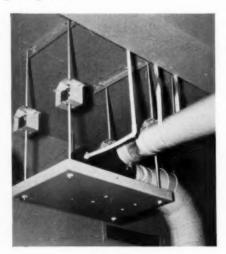
In woodworking plants, foundries, and other places where there is considerable dust, a totally enclosed, fancooled motor can be used.

If a changed plant process produces

lint, it would be advisable to replace open motors with a textile mill type having screened openings. A plant or a room with combustible dust is a hazardous location. For such locations, requirements for electric equipment are definite and are presented in another part of this discussion.

#### Temperature Control

Practically all standard electric apparatus, and also some devices, are designed to develop their rated capacities without exceeding a specified temperature rise above an ambient temperature of 40 C (104 F). Where equipment must operate in low temperature, such as 0 C (32 F) and below, the insulation may not be affected but parts may have sluggish operation due to congealing of oil.



VIBRATION-PROOF suspension mounting of an exhaust blower and motor in the jewelry manufacturing and repair department at Tiffany Co.'s new building in New York City

For small cabinets containing relays, where additional heat is needed, a 60or 100-watt lamp, or a small strip heater, may be sufficient. For small rooms and isolated spaces, electric heaters can be used. For bearings, industrial heating cable can be wrapped on the bearing housing. For oil in autotransformer starters, strip heaters may be attached to the bottom of the tank.

For electrical thawing of frozen water pipes, see the Maintenance Guide Sheet on opposite page.

Where equipment operates in high ambient temperatures, say 30 C (86 F) and above, the main thing to observe is the load, to prevent overheating and deterioration of insulation. In all cases free circulation of air is necessary. Removal of excess heat or production of lower effective temperatures is made possible by suitable ventilation, as covered in another part of this discussion. Proper alignment of equipment is also necessary to prevent local heating,

thereby eliminating, or at least minimizing, any increase in equipment temperature above that caused by the high ambient temperature.

Where equipment operates in wide changes of temperature, "breathing" will undoubtedly occur. Provision must be made to drain the condensation. If the equipment operates when the temperature is high, and is shut down when the temperature is low, sometimes it may be advisable to operate idle or at light load so as to maintain sufficient heat to keep moisture out of the insulation.

Wires and cables whether used in free air or in raceways have allowable current-carrying capacities based on a room temperature of 30 C (86 F). For higher room temperatures, the carrying capacity will be lower (see National Electrical Code, 1940, Chapter 10, Tables 1 and 2). Maximum operating temperatures for conductor insulations are set, ranging from 50 C (122 F) for type R insulation to 200 C (392 F) for asbestos insulation.

Where operating temperatures are higher than that for the existing insulation, it will be necessary to rewire, using insulation suitable for the higher temperature. For rewiring only, the recently approved new insulations can be used. They are: RHT suitable for use at 75 C (167 F) maximum; RPT, RU, and SN for 60 C (140 F) maximum.

At low temperatures, approximately 0 C (32 F), practically any insulation may be used that is suitable for the location. However, synthetic insulation (SN) may have to be replaced because it stiffens; also care should be used in its installation at the low temperature.

#### Moisture Control

Moisture often penetrates insulation and causes corrosion of metal parts unless special precautions are taken. Rigid conduit runs overhead and on walls should be free from sags so as to prevent condensation being pocketed. Wherever possible, the runs should have a slight pitch to provide for drainage. Conduit fittings should have a galvanized or a cadmium coating, or be made of a noncorroding material.

To meet conditions where there is a moderate degree of moisture, such as in some basements and some cold storage warehouses, conductors with moistureresistant insulation (type RW) can be used. Conductors with lead sheath are required for conditions where there is saturation by water, such as locations exposed to weather, or wash rooms in garages, as well as in runs underground, in concrete slabs or masonry in direct contact with the earth.

#### MAINTENANCE GUIDE SHEET

#### ELECTRICAL THAWING OF FROZEN WATER PIPES

By Use of A-C Power and Transformers

#### EQUIPMENT REQUIRED

Principal items required for the thawing operation are: power transformers, fuse cutouts, ammeter, current transformer, wire for power circuit and transformer connections, and cable for secondary circuit.

Capacities of transformers and sizes of cables are given in the table. Standard distribution transformers may be overloaded approximately 50 per cent because of their intermittent duty and the low ambient temperature usually prevailing during the thawing operation. Suitable primary fuses will permit overloading the transformers.

One arrangement for the electric equipment is shown in an accompanying diagram. The primaries of the two transformers are connected in series to a 2,400-volt, single-phase circuit. The 120-volt secondaries are connected in parallel to obtain 60 volts for the thawing circuit. For 120 volts on the secondary side, standard transformer connections are used.

#### VOLTAGE USED

Cables from the secondaries of the transformers are connected to the ends of the frozen section of pipe. Thawing current is applied at 60 volts or less, depending on the kind, size, and length of pipe. Lower voltages can be obtained by introducing reactance into the secondary circuit.

The current flow indicated on the ammeter must be noted before the reactance is reduced or changes are made for higher voltage connections (120 and 240 volts).

#### CURRENT CONTROL

Amount of current may be regulated by increasing or decreasing the length of

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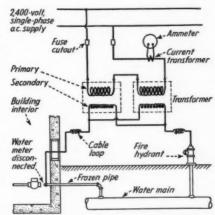


DIAGRAM OF TYPICAL CONNECTIONS
for thawing frozen water pipes

pipe between the cable terminals. Another method is by changing the reactance of the secondary circuit, which can be done by varying the number and size of current control loops. Close adjustment of the current is unnecessary. The loops are employed to keep the current flow within reasonable values.

Ordinarily, 100 to 200 amp. are sufficient for ¾- to 2-in. diameter pipes; 200 to 300 amp. for 2- to 6-in. diameter pipes; and 300 to 500 amp. for 6- to 10-in. diameter pipes. The table gives data for the amperages most frequently used.

#### THAWING TIME

Time required to thaw pipes is dependent on various factors, such as size, length, and kind of pipe, location, extent of freeze, pipe joints, condition of soil, and ambient temperature. However, experience has shown that pipes can be thawed

in from 5 to 20 min. when 100 to 300 amp, are used in the secondary circuit.

#### OPERATING POINTS

If the pipe to be thawed is between the water main and building, disconnect the pipe at inlet to water meter, to prevent stray currents passing to gas pipe or grounded electric circuits. Connect one cable terminal to end of pipe near the water meter; the other terminal to the water main or a fire hydrant.

If the frozen section of the pipe extends into the building, disconnect entirely the water meter and gas meter, also any gas-pipe connections and all ground connections. Connect electrically the two sections of pipe at the watermeter. Connect one cable at the most remote point on the frozen section of pipe in the building, and the other cable to the water main or fire hydrant.

Have a minimum of excess pipe in the circuit. Remove grease and corrosion so as to have clean contact surfaces on the pipe. Use bare copper wire to bind cable terminals to pipe.

Occasionally check electric connections to pipes, fire hydrants, transformers and cable joints. Regulate the amount of current so that the lead gocse-neck between the service pipe and water main will not be overheated.

Where pipes do not make a firm metal to metal contact or joints are gasketed, thaw the pipes by sections. Note soil conditions because some soil has a conductivity that induces current to leave the pipe, hence, greater time will be required. Open shut-offs, valves, and faucets so that when the ice starts melting, the flow of water will complete the thawing process.

Thawing Currents, Volta	ge Drop, Transformer Capacities and Connections,
for Various	Sizes of Pipe in 1,000-ft. Lengths
100 4	000 4

	100 Amp. (Two 7½-kva Transformers)			200 Amp. (Two 15-kva Transformers)			300 Amp. (Three 25-kva Transformers)					
Kind and Size of Pipe	Drop in Pipe (volts)	Drop in No. 3 TBWP Leads* (volts)	Total Drop (volts)	Transf. Connection (volts)	Drop in Pipe (volts)	Drop in No. 3 TBWP Leads* (volts)	Total Drop (volts)	Transf. Connection (volts)	Drop in Pipe (volts)	Drop in No. 3 TBWP Leads* (volts)	Total Drop (volts)	Transf. Connection (volts)
Steel				10	4.5	25		400	75	FO	105	400
3/4-in	1	24	44	60	45	35	80	120	75	50	125	120
1-in		24	39	60	30	35	65	60	50	50	100	120
1½-in	10	24	34	60	20	35	55	60	35	50	85	120
2-in	7	24	31	60	17	35	52	60	30	50	80	120
Cast Iron												
3-in	10	24	34	60	25	35	60	60	45	50	95	120
4-in		24	32	60	17	35	52	60	28	50	78	120
6-in	1	24	30	60	14	35	49	60	24	50	74	120
8-in		24	28	60	10	35	45	60	17	50	67	120
10-in		24	27	60	8	35	43	60	14	50	64	120

<sup>\*</sup> Connection leads: 1,000 ft. of single-conductor TBWP wire

NOTES: Table based on pipe data published by American Water Works Association. . . Use proportionate values for other lengths of pipes, leads, and thawing currents. . . For wrought iron pipe, use values given for steel. . . For lead pipe, allow 50 per cent increase in pipe drop.

Distribution transformers using oil or a nonflammable liquid, instead of air, as a medium for cooling are to be given preference for service where considerable moisture exists.

Motor windings should have Class B insulation. Contactor, relay, solenoid, and other forms of magnet coils should have suitable insulation for protection against moisture. Glass insulation for motor windings and magnet coils has been used recently to meet the same conditions. Ferrous metal parts such as motor frames and bases, enclosing cases and supports, and capacitor cases, can be protected against corrosion by being painted.

#### Exposure to Weather

When it is known that the installation will be for outdoor use, the electric equipment should be obtained for that purpose. For example, motors should have suitable insulation and enclosing features. Switches, starters and pushbuttons should be in weatherproof cases. Wiring should be in conduit, or open runs have weatherproof insulation or a lead sheath.

When standard open motors and starters are used outdoors for emergency or temporary service, they can be protected by a wood or metal housing. Likewise, capacitors, drum controllers and resistors, indicating and recording instruments should be housed. But in every case provision must be made for adequate ventilation. It is advisable to provide similar protection for electric equipment used in an open shed or lean-

To prevent corrosion of motors, control enclosing cases, and capacitors unprotected or partially protected from the elements, the outer surfaces should be painted. First, clean corroded spots and bare metal and smooth the entire surface clear of dust and grit. Then remove grease and oil with a solvent.

#### Hazardous Locations

Use or storage of certain kinds of materials or again changes in processes will sometimes create conditions that must be recognized immediately as hazardous. Ignition of fumes, dust, and linters, and spontaneous combustion must be prevented.

An important safeguard is the use of electrical apparatus and devices of a construction designed for hazardous locations. In some plants it is practical to move air circuit breakers, switches, transformers, motors, controllers and capacitors to a separate and well ventilated room. In either case, the wiring must be changed to meet the hazard classifications.

The National Electrical Code classifies the hazards as follows: Class 1, airfume combinations; Class 2, dust-laden atmospheres; Class 3, ignitible fibers and linters; Class 4, stored combustible fibers. Code requirements are exacting. The electrical maintenance man carries a heavy responsibility if he installs equipment that is not designed for the respective hazard.

Briefly stated, the code specifies that for Class 1 locations the electric equipment shall be explosion-proof; for Class 2, dust-tight, but motors may be totally enclosed, totally enclosed fan-cooled, or totally enclosed pipe-ventilated. For Classes 3 and 4, requirements are practically the same as for Class 2 but with some modification for use of electric cranes and trucks in warehouses. For full details of requirements refer to N.E.C., 1940 edition, Chapter 5.

#### Mechanical Damage

Mechanical damage to electric equipment is usually a physical injury caused by an outside source. Underground service conductors are considered as being protected against mechanical injury when they are installed in conduit, duct, in an approved form of cable, or by other approved means.

Conductors above driveways on plant premises should have a clearance above ground of not less than 18 ft. for 600volt circuits, and 20 ft. for circuits of more than 600 volts. Conductors carried up a pole may be protected from mechanical injury by being placed in rigid conduit which extends at least 8 ft. above the ground. Where conduct-

A CRACKING PLANT-Circuit breakers and motor starters are enclosed in explosion-proof housings

ors emerge from a lead sheath, a pothead will provide protection from mechanical injury and moisture.

To meet the requirements of the Code, all live parts, including conductors, if accessible to unqualified persons, must be enclosed or isolated. As to isolation by elevation, the minimum distance above the floor, ground, or working surface is 8 ft. for circuits up to 6,600 volts. The same distance can be used as a guide for protection from mechanical injury, particularly for wiring on the exterior or interior of building walls. If the distance is less than 8 ft., the conductors should be protected by conduit or electrical metallic tubing.

Transformers and grouped capacitors when mounted on the floor can be protected by grill work. Small units can be mounted at an elevation on the wall or on cross members of the building structure, thus eliminating damage which might be caused if located on or near the working surface. Distribution cabinets should have doors and gutter plates in good condition and in place to protect the contained switches, protective devices, and conductors.

Motor windings can be protected from flying chips by attaching a screen at the motor openings. Where materials, tools or liquids are liable to drop on motors, a slightly arched metal sheet will afford some protection, when extended the full length and a few inches above the motor. Screens and other covers for motors must be used with discretion so that motor ventilation will be unaffected.

Motor starters and other control devices should have covers and enclosing cases in good condition. Where possible, individual equipments of this type may be isolated from the machine, or centralized at a remote location, to eliminate possible mechanical damage in operating areas.

#### Prevent Vibration

Vibration can be either self-made by or transmitted to electrical equipment. Here are several points to prevent vibration and ultimately mechanical damage.

- 1. See that equipment with moving parts has substantial supports or foundation.
- 2. Securely fasten equipment to its foundation or supports.
- 3. Check moving parts for free operation. 4. See that equipment is correctly aligned with the direct-connected or geardriven machine.

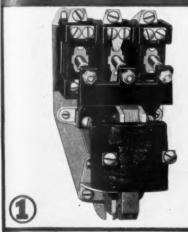
5. Operate belts and chains with the least amount of slack that is consistent with good practice.

6. Use vibration-reducing devices.

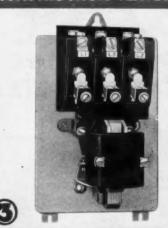
7. Use vibration-absorbing material such as cork, felt, or rubber. Manufacturers of these materials have developed their own formulas for applications and will gladly extend the benefit of their experience.

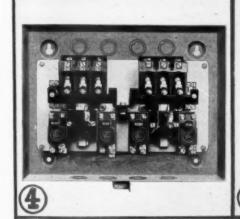
### Some "3C" 1940 Major Developments

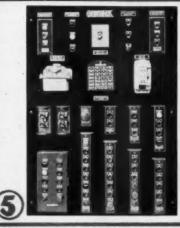
EMBODYING TRADITIONAL CLARK ENGINEERING AND CONSTRUCTION FEATURES

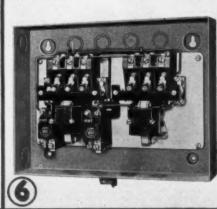


















- Bulletin 7305 Relays for Heavy Duty A.C. or D.C. Service.
- 2. Bulletin 6013, Sizes DS-0 or DS-1, Acrossthe-Line Starters.
- 3. Bulletin 7707 Contactors for standard or Heavy Duty applications.
- Bulletin 6050, A.C. Automatic, Multi-Speed Across-the-Line Starters.
- Bulletin 100, Type "D" Heavy Duty Push Button Stations.
- Bulletin 6030 A.C. Automatic, Reversing Across-the-Line Starters.
- Bulletin 102 Snap Action Track Limit Switches with Roller Fork Lever. Other type levers available.
- Bulletin 101 Foot-Operated Heavy Duty Master Switches.
- Bulletin 102, Pilot Circuit Crane Hoist Type Limit Switch.

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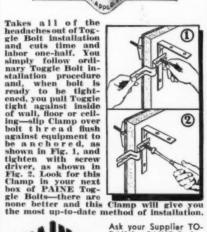
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#### Applications for Small Fluorescent Lamp

For illuminating business machines, niches, cabinets, curved showcases and coves, airplane and ship cabins, mirrors, and paintings, a 6-watt mazda fluorescent lamp only 9-in. long may be suitable.

The lamp can be used for local lighting where space is limited and high lumen output is not required. It has a bi-pin base and may be burned in any position. Initial lumens per watt for daylight color is 26, and for white, 30. Rated average life is 750 hours.

#### "Electric Eye" Spots Pin Holes In Steel Strip

Spotting holes as small as one-hundredth of an inch in sheet steel traveling at a speed as high as 1,000 ft. per min., a photoelectric hole detector simplifies quality production in a steel mill shearing line.

The illustration shows the equipment arrangement. Direction of travel for the metal sheet is from right to left. Before entering the hole detector (at right), the steel strip is trimmed along the edges to uniform width and passes between guides and hold-down blocks.

Two light sources are mounted in the overhead enclosing cabinet, and the phototube housing is mounted below the moving stream of metal sheet, on a separate foundation to avoid vibration. The slightest hole in the steel strip lets the light through, actuating the phototube and a marking device which scores the strip alongside the hole. The

two control cabinets mounted on the side are for the detector unit and for the marker.

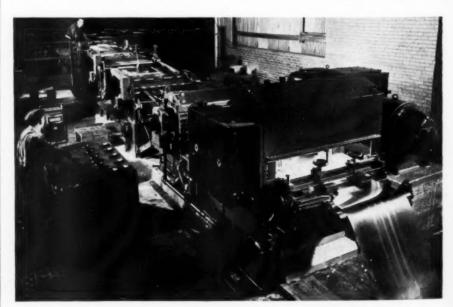
Immediately beyond the pin-hole detector, there is a machine to cut the strip into exact lengths which may be adjusted over a wide range. After leaving the flying shear, the strip goes to a classifier which has a gate, timed with the hole detector, to open and discharge all defective sheets to a pit below. Final process in the line is to pile the sheets into stacks for convenient handling.

#### **Electric Welding** Saves Old Stack

An ingenious electric welding job on two badly corroded 75-ft. steel stacks saved a large public utility company from a possible plant shutdown with its accompanying financial loss, plus the additional cost of entirely new boiler stacks. Neglecting a plant shutdown, the repair by welding was less than 1 the estimated cost of new stacks.

Engineers inspecting two of the company's three 20-year old steel stacks found that the 8-in. thick steel center plates had been corroded down to as little as of in.; in some places found a full 4 in. of rust. Cause was the corrosive action of combustion products from the forced-draft coalfired boilers. In an effort to forestall a possible shutdown, the company called in the Weldrite Corporation, and asked them to repair the stacks, if possible.

To solve the problem of supporting the top half of the stack so that the corroded plates could be removed, offset steel angles were welded across the faulty section. The old plates were cut out, leaving the stack's upper portion supported only by the angles. It is believed that this is the first time such a method of support has ever been



GENERAL VIEW of the steel sheet shearing line equipped with a photoelectric hole detector (at near end of line). Operator (left) is at control desk, where he has suitable test instruments and control switches to properly manipulate the steel through the entire shearing line. (Westinghouse photo)

# For Ticklish Jobs Moisture -- Where There's Vapor or Moisture

Type "GST" Unilet with No. 19170 Convertible Vaportight Fixture



Type "GSB" Unilet - 2-Gana with Vaportight Switch Cover and Spring Door Plug Receptacle Cover







Type "GSL" Unilet with Screw Cap Plug Receptacle Cover

#### Appleton "GS" Series Unilets are the Perfect Answer

Skillfully designed to meet, with room to spare, exacting conditions in cold storage plants, marine locations, subways, garages, and the hundreds of other installations where vapor and moisture must be "licked before they start."

Appleton "GS" Series Unilets offer widest possible flexibility of application. In addition to their use as junction, switch and fuse

boxes, they work smoothly in combination with other Vaportight Appleton fittings, such as lighting fixtures, plug receptacles, and housings.

Bodies are roomy, with ample space for wiring and for additional circuits. Cast of malleable iron in Appleton factories; smooth and free from flaws. Heavily cadmium coated.

You'll save valuable time getting materials together, and you'll always have exactly the type of fitting you need for every outlet, by specifying "Appleton" on every fit-

> ting order. The Appleton line is extensive-COMPLETE. Service is fast and dependable. Write for catalogs and name of nearest Appleton wholesaler.



The name "Appleton;"
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This new red and black label and the "Inch-Marking" identify genuine ELECTRUNITE STEELTUBES. Look for them on every 10-foot length.



#### A NEW BENDER

The new ELECTRUNITE Bender enables you to make bends easier and more accurately than ever before possible. Instructions are built into each bender.



#### A NEW BENDING TAG

This new bending tag supplied with each bundle of tubing provides complete simple bending directions and diagrams for making all standard types of bends.

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## e this "INCH-MARKED' Tubing!"

Don't take our word for the advantages of "Inch-Marked" ELECTRUNITE STEEL-TUBES. Let your workmen try it, bend it and cut it under actual conditions on a wiring job. Then let them tell you what they think of it.

Other workmen who have used this "Inch-Marked" electrical metallic tubing would rather use it than ordinary tubing—for these three reasons:

- The little marks which indicate inches and feet on the tubing provide a continuous foot-rule on every length—reduce the bother of folding and unfolding a pocket rule.
- 2. It's not necessary to juggle a flat foot-rule against a slippery round tube while trying to hold it steady to make a pencil mark for cutting or bending. The mark already is made—accurately.

3. With "Inch-Marked" ELECTRUNITE STEELTUBES and the new ELECTRUNITE Bender, true bends of any standard type or radius can be made with less effort.

Then, here's something more to consider: Because "Inch-Marked" ELECTRUNITE STEEL-TUBES insures accuracy in cutting and bending—reduces chance for error and eliminates guesswork—it saves material. And when it's practical to prefabricate bends in your shop, the work is easier and the bends always fit.

Use "Inch-Marked" ELECTRUNITE STEEL-TUBES on your next wiring job—exposed, concealed or in concrete. Check the results and see what a world of difference a few "Inch-Marks" make. Steel and Tubes Division, Republic Steel Corporation, Cleveland, Ohio.





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ELECTRUNITE Distributors in all principal distribution centers carry complete stocks of "Inch-Marked" ELECTRUNITE STEEL-TUBES, fittings and other high quality electrical supplies—ready for prompt delivery. Get in touch with your local Distributor. He can help you in laying out and figuring

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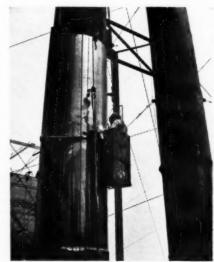


WORK-SAVING PIPE TOOLS

employed for a welding job of this kind.

Then the welders made a replacement with new steel plates. Working swiftly, they welded in place on each stack eight 9-ft. by 4-ft. by \( \frac{3}{2}\)-in, new plates. Three-inch vertical overlaps were employed at the junctures of the old and new steel. During the time the center section plates were out, the boilers were shut down, but before completion of the welding, they had been re-fired.

If a new brick chimney had been built,



WELDING new center section plates on this 75-ft. boiler stack saved a large public utility from building a new structure with consequent long, costly boiler shutdown. A 200-amp. Westingbouse welder, and 200 lbs. of 5/32-in. electrodes were used on this job, enabling a considerable monetary construction and operating saving to be made.

or new steel stacks provided, the boilers would necessarily have had to shut down completely while breeching was being installed or stacks were erected. Cost of repairing the two steel stacks by welding was done at less than 1/5 the estimated cost of a new brick structure, not taking into account the expense of the shutdown which would have been necessary.

#### Grouped Controls Reduce Maintenance

Controls for punch presses, rolling machines, lacquer ovens, and welding equipment at Rheem Barrel Co., Newark, N. J., are grouped for economics of maintenance and conservation of floor space. The grouping was on angle-iron racks on three control platforms, each 18 by 10 ft., supported 20 ft. above the production floor and under the monitor type roof.

Switches and controls are mounted on both sides of vertical angle-iron framework which runs along the center of the 10 by 18 ft. platforms, leaving a 5-ft. work space in front of the equip-

Feeders (440-volt, 3-phase) enter one end of a pull box that runs along the

## TWO Proved TIME-SAVERS TWO Proved TIME-SAVERS BENDING!

### Porto-Power

handles tough bending jobs as they come — right at the job! Savings in time alone more than pay for this low-cost, portable, super-range S-36 Porto-Power Bender. Light weight, rolls to the job, gives you easy, speedy setups — makes smooth, accurate bends on 7 pipe sizes from 1½" to 4" dia.

**DEPENDABLE!** Features famous Black-hawk remotely controlled, all-directional, 20-ton hydraulic Porto-Power Ram.

**BIG EXTRA UTILITY!** Used with special attachments for pulling gears, pulleys, lifting machinery, etc., and big range of push, pull, spread, press and lift jobs in construction and maintenance.



Porto-Power Benders are truly portable—easy, fast and safe to operate.



#### LOW COST S-30A HANDLES 4 SIZES

Has practically all the performance features of the larger S-36—but is equipped with 10-ton all-directional, remotely controlled hydraulic unit. Handles 1",  $1\frac{1}{4}$ ",  $1\frac{1}{2}$ " and 2" pipe and rigid conduit. Extra handy for use on ladders, scaffolds and in close quarters. Porto-Power Hydraulic Unit also serves as JACK, and with special attachments for many other jobs allied to electrical installations.

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BLAC	KHAWK N	FG. CO., Dep	t. P2	2011, N	filway	ikee, Wis.
Rush	complete	information	on	your	Pipe	Benders.
Name		***************************************	******	*********	*********	
Comp	any	*******************	******		********	**********
Addre	085	********************	*******			

#### INSULATION AND WIRES INCORPORATED

takes pleasure in announcing their appointment as DISTRIBUTOR for the

#### NEW MALLORY Universal **AC CAPACITORS**

Write Today for Catalog to Any of the Following:

- INSULATION & WIRES, INC. St. Louis, Mo. 2127 Pine St.
- . INSULATION & WIRES, INC. 30 Trowbridge Ave. Detroit, Mich.
- . H. A. HOLDEN CO. 318 4th Ave. South
  - Minneapolis, Minn.
- . T. F. COUGHLAN CO. Boston, Mass. 236 State St.
- W. C. JOHNSON 309 Kellogg Ave.
- . TRI-STATE SUPPLY CO. 544 S. San Pedro Los Angeles, Calif.
- ELECTRICAL INSULATION SUPPLIERS 289 Simpson St., N. W.

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#### INSULATION AND WIRES INCORPORATED

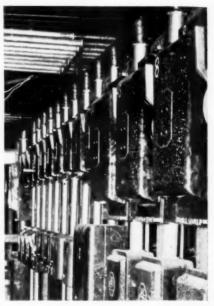
Peoria, III.



and sizes of electric motors. Instantly available from stock always carried by Bunting wholesalers and Bunting warehouses in all markets . . . The Bunting Brass & Bronze Company, Toledo, Ohio.



Write For Catalog



SWITCHES AND CONTROLS mounted back-to-back and grouped on angle-iron framework simplifies maintenance, minimizes vibration, and releases space for production in steel barrel plant.

top of the framework. Taps are taken off at regular intervals through the bottom of the pull box, pass through the switches and controls which are mounted one above the other, and lead to the different machines.

Arrangement of the controls, construction of the platforms, and modernization of the electrical distribution system throughout the plant was done by Edward J. White Co., Newark, N. J.

#### Power-Factor Improved

When modernizing the drives, the Doyle Shoe Co., Brockton, Mass., installed 27 motors totaling 88 hp. and eliminated a 90-hp. steam engine with an extensive system of shafting and belts.

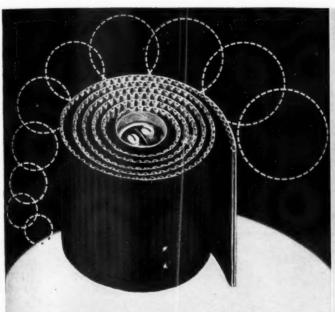
Power factor was approximately 70 per cent caused by the induction motor load. But the power factor was raised to almost 100 per cent by the two following methods:

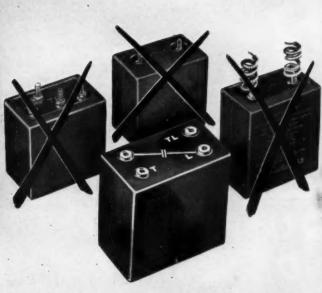


MOTOR for power-factor correction. driving blower. Control equipment mounted on adjacent wall.

### MALLORY Universal AC CAPACITORS

The First Practical Answer to Simplified Replacements





ANY NEEDED DIAMETER OR HEIGHT

ONE CAPACITOR
REPLACES ALL THREE

This newest Mallory development makes cumbersome inventories for Motor Start Capacitor replacements as outmoded as an ice box. Round types MSU are all housed in the smallest diameter and shortest height metal container possible. Each is packed in a specially developed "size adjuster" providing any diameter to a maximum of 3" and any height up to  $4\frac{3}{4}$ ". This adjuster is calibrated for all sizes.

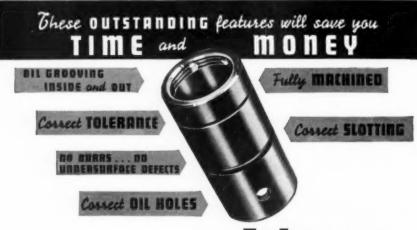
All you do is trim it for the exact size you need. Rectangular types MSG and MSF are packed with complete hardware—leads, lugs, studs, nuts and screws for any installation need. Mallory Universal AC Motor Start Capacitors will save you time, money, and reduce your inventory investment. Mallory's reputation is your guarantee of quality.

#### Send for Catalog

Write today, giving your distributor's name, for Catalog M-801. It contains full details and complete replacement recommendations.

P. R. MALLORY & CO., Inc., INDIANAPOLIS, INDIANA . Cable Address-PELMALLO





#### Johnson **Electric Motor Bearings**

 You can avoid costly delay in securing Electric Motor Bearings-if you select Johnson Bronze. Over 250 individual types are carried in Stock at all times. Available both in Standard or Undersize. Cast in a special high lead alloy, they deliver the maximum performance and bearing life. Write for our new catalogue . . . today.



#### JOHNSON BRONZE

Sleeve BEARING HEADQUARTER 490 S. MILL STREET · NEW CASTLE, PA.



notes it occupied buildings and offices where noise isobjectionable—frequentlyrequiringafter-hour work—the Carboloy Masonry Drill permits work at any time without disturbing occupants. It's QUIET—eliminates all noisy hand chiseling of holes. Saves time too! Drills holes in concrete, tile, porcelain, brick, etc. 50%—75% faster! Last longer! Stays sharp for long intervals of continuous use because it's tipped with Carboloy cemented carbide—a metal approaching the diamond itself in hardness. And here's another valuable feature: Carboloy Drills won't splinter fragile work. Drills clean, accurate holes.

Use in any rotary drill. Send for leaflet.

Use in any rotary drill. Send for leaflet.
FREE
LEAFLET
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Carboloy Co., Inc.  Carboloy Co., Inc.  Mile Blvd., Detroit  Masonry  11135 E. 8 Mile on Carboloy  Send free leaflet on 75% faster  Drill-Points, for drilling 75%
Caros E. 8 Martet on 75% Inst
and free leafor drilling
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CARROLOV
CARBOLOY
VAIN DO DO I
MASONRY DRILL-POINTS
MASONKI DKILL-POINTS

#### Here's to . . . Clean Cut Contract Work for 1941!



WE hope you have all had a good year, and are all set for an even better one ahead. Many of you are taking full advantage of the simplicity, time saving, material saving and neatness made possible by BRIEGEL METHOD Connectors and Couplings. That's why 1940 has brought us hundreds of new friends. And for 1941, we offer the most highly perfected connector available. Let it help you turn out many fast, clean cut and profitable

BRIEGEL METHOD TOOL CO. Galva, Illinois

(1) Use of a number of specialized electrical units for the production of steam vapor by an electrolytic process, installed by Boston Manufacturing Co., Whitman. Mass.

(2) Use of a 25-hp. Fynn-Weischel motor to drive a 50-in. Sturtevant blower for exhausting leather dust from various machines. The motor alone reduces the demand charge by approximately \$60 per

The blower is a relatively uniform load and operates continuously when the plant is in production. The motor has a running speed of 1200 r.p.m. and drives from an 8-in. pulley through a triple V-belt to a 12-in. pulley on the blower.

#### **Electric Annealing** Saves 25 Per Cent

A saving of 25 per cent in the cost of annealing forged steel unions has been realized by the Rockwood Sprinkler Co., Worcester, Mass. since the installation of a continuous electric furnace equipped with atmospheric control. A stronger and more uniform product has been obtained as a result of the closer temperature control possible with the electric furnace.

Unions, ranging from \(\frac{1}{8}\)- to 3-in. pipe size, have to be annealed after each of several forging operations in order to remove strain stresses set up by the cold working. They were previously batch annealed in fuel-fired furnaces having no atmosphere equipment. Qualitative results, as determined by Olsen pull tests, varied as much as 9 per cent between different unions in the same batch.

The electric furnace is a 90-kw. Westinghouse unit, approximately 50 ft. in length and replaces two furnaces of the oil-burner type. Atmospheric control is obtained by burning city gas and air in a combustion chamber and feeding the product of combustion into the annealing chamber.



ENTRY END of electric annealing furnace. Flame under combustor flue is part of atmospheric control and prevents outside air from entering furnace chamber.

Materials to be annealed are loaded into trays whose maximum capacity is about 250 lb. each; these are moved through the furnaces' three temperature zones by a hydraulic pusher actuated by a \frac{3}{4}-hp. electric motor. The furnace control system includes an automatic shut-off feature in case of gas or power failure.

This furnace, because of its faster operation, has eliminated a serious plant



TEMPERATURE CONTROLLERS, working on potentiometer principle, keep temperature uniform in the annealing furnace. C. P. Howard, plant superintendent, points to indicating controller. Recording controller is at the right.

bottleneck. Its accurate control of temperature has reduced batch variation to as low as 0.4 per cent on 1\(^4\)-in, unions. The use of atmospheric control has eliminated the pickling operation which was necessary with the old oil furnaces, due to scaling of the product. Lower unit power costs have been realized with the new furnace than were possible with the oil burners. Figured on a 15-year amortization basis, the saving thus far per hundred pounds of annealed material amounts to 25 per cent.

#### Maintenance of Plant Protective Equipment

Protective measures for the plant are always a necessity, and more particularly at this time when materials are being produced for defense needs. In addition to the proper selection and installation, there is the upkeep of protective equipment which is the responsibility of the electrical maintenance man. A few check points will serve as a guide.

1.—Are outdoor lights inaccessible to

unauthorized persons or intruders?

2.—Are lamps securely seated in sockets, and protected from vibration, missiles, and

3.—Do reflectors and lamps need cleaning?

4.—Are light and power circuits as nearly tamper-proof as possible?

5.—Do feeders and branch circuits have adequate capacity to handle the additional light load when the plant operates with a night shift?

6.—Are interplant and out-of-plant telephone and signal circuits protected against "accidental" interruptions?

## FAST CAPACITORS



FAST dust-tight capacitors are installed at individual machines to reduce feeder losses and improve voltage regulation.

Dust-tight units are neat, sturdy, compact. They are complete with fuses, discharge resistors, conduit box, knockouts and mounting brackets. FAST dust-tight units are built in double containers to insure the utmost in performance.

Investigate the economies of FAST dust-tight units. Write for catalogue #20 for a listing of FAST industrial capacitors.



ESTABLISHED 1919

3119 N. CRAWFORD AVE.

CHICAGO, ILLINOIS

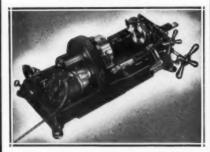
#### **Immediate Delivery!** Pipe and Bolt Machines From \$125.00 Up!



#### Beaver Model-A

A high-speed heavy-duty deluxe Pipe and Bolt Machine. Range ½ to 2-inch-up to 12-inch with geared tools and drive shaft. Bolts, ½ to 2-inch. Wt. 415 lbs.

From \$309.50 up Write for Bulletin A



#### Beaver Model-B

A light-weight utility Pipe and Bolt Machine combining many features of Model-A with the easy portability of Model-C. Range ¼ to 2-inch up to 8-inch with drive shaft and geared tools. Bolts up to 1½-inch. Weight 230 ibs.

From \$217.50 Up Write for Bulletin B



#### Models C-1 and C-2

A sturdy little Power Unit Converts hand pipe tools into power tools from % to 8-inch. Threads 8-inch in 6 minutes. Threads bolts up to 1½-inch. Two men can work at the same time without interference. Weight 150 lbs.

From \$125.00 up Write for Bulletin C

Write for new Tool and Machine Catalogue—Just off the press

## BEAVER

141 Deen Ave. Warren, O.

7.-When was the last test made on fire and burglar alarm systems?

8.—How recent have telephone and alarm system batteries been inspected, tested and serviced?

9.-Have low-voltage terminals at transformers, lamps, bells, gongs, sirens, been inspected, cleaned and tightened?

10.—Do terminal blocks and fuses have covers and are they inaccessible to unauthorized persons?

11.-What signal or communication circuits are vulnerable?

12.-What provision is made for the least number of circuits that will be affected on a power, light, communication or signal system, if an "accident" occurs to a circuit on one of the respective systems?

13.-How recent has an inspection and test been made of the switch-over equipment for emergency light and power?

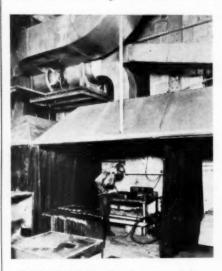
14.—Have photoelectric control devices been tested and lenses on light sources been cleaned?

15.- Is an adequate stock of spares immediately available for restoring electric service on the protective systems?

#### Ventilation Provided For Grinding Booths

Dust and grit are removed from grinding booths by three blower systems at the Caldwell-Moore plant, housing the Stoker Division of the Link Belt Co., Chicago.

Air, laden with dust, is exhausted from the tops of the booths through ducts by blowers, each handling 5,000 cubic feet of air per minute at 1-in.



DUST LADEN AIR is removed from grinding booths by overhead blowers

static pressure. The blowers, manufactured by Ilg Electric Ventilating Co., operate at 685 rpm., direct connected to 440-volt, 3-phase, 60-cycle motors.

The installation was made to meet the State of Illinois ventilating requirements. All three systems have been satisfactory and trouble-free from the time they were put in operation.



WRITE FOR FOLDER No. 300

TRICO FUSE MFG. CO., Milwaukee, Wis.

#### DRILL CONCRETE the Easy Way



The old arm and hammer method is slow, hard and expensive. Use the Wodack "Do-All" Combination Electric Hammer and Drill and drill 15 times as fast in concrete and mason ry. Two tools in one. With hammer member removed it's an electric drill with ½" chuck. Cuts cost of drilling for expansion anchors. Universal motor 110 or 220 v. Ask for Bulletin.

WODACK ELECTRIC TOOL CORP. 4628 W. Huron Street - Chicago, III. Phone AUSTIN 9866

#### SHBOARD



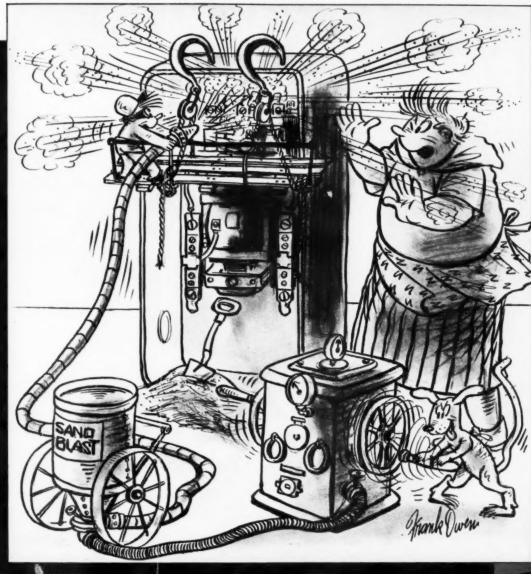
BUTTON ON THE DASH . . . GARAGE DOOR OPENS.

SEE OUR AD, PAGE 309 OF 1941 ELECTRICAL BUYERS REFERENCE

Doors and Operators, Inc.

Tiffin, Ohio

528 Hudson St.



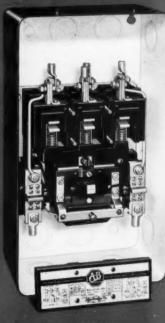
Bulletin 709 Size 4 Starte

## "Stop it! Mama told you those cadmium silver contacts never need cleaning!"

Mama is right! The patented cadmium silver contacts in Allen-Bradley solenoid starters never need cleaning or filing. They are always in perfect operating condition—no matter what the service may be.

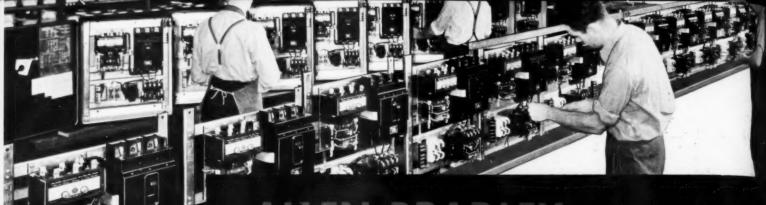
The Allen-Bradley solenoid starter has other advantages, too. It has only one moving part. Bearings, pivots, pins, and hinges are eliminated, thus reducing the possibility of starter trouble to a minimum. In addition, there are ample wiring space, white interiors that reflect light in dark corners, many knockouts, accessible terminals, and removable cabinet covers. It will be to your advantage to specify Allen-Bradley solenoid starters on your next job.





No Contact Maintenance with A-B Solenoid Starters

A-B parented cadmium silver contacts should never be touched Oxides that form on them conducturent as well as the metal itself Filing or dressing these contacts.



are built with these STANDARD UNITS

Save time . . . avoid costly experimenting ... enjoy the benefits of reliable motor controls by using A-B panels, built to your special requirements, with standard A-B solenoid controls and accessories. They assure freedom from every control trouble.



Bulletin 709 - For across-theline squirrel-cage motors. Simple, rugged construction.



Hand-operated safety switch or circuit breaker. Safety switch has silver alloy contacts.



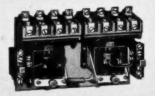
Bulletin 700 - Furnished in over 300 types. One to eight poles. Compact and reliable.



**Hand-Operated Switches** Bulletin 609 - A quick action switch. Push-button control and overload protection.

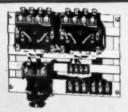


Solenoid Contactors Bulletin 702—Sturdy construction. Available with 2 to 4 poles-ratings 10 to 100 amp.



**Reversing Switches** Bulletin 705 - For reversing squirrel-cage motors. Provides solenoid reliability and speed.

ACCESSORIES



**Multi-Speed Starters** Bulletin 715 - For 2, 3, and 4-speed across-the-line motors. Also in the resistance type.



#### **Terminal Blocks**

The convenient terminal blocks of Allen-Bradley custom-built panels assure correct wiring and save installation time.



Bulletin 800—For surface and flush mounting, in a large variety of button combinations.





Bulletin 801 - Furnished in 253 different types. Limit switches for any machine tool.



A-C and D-C Solenoids Bulletin 860 - Quiet opera-

tion. In 8 sizes and various mountings. Thrusts to 16 lbs.



ALLEN-BRADLEY SOLENOID MOTOR CONTROL



#### REWIRING IN TILE ARCH

A midwest contractor was recently called on to install a wiring system in a building which had tile arch construc-The 18-foot ceiling was finished with 3-inch plaster. Channels were cut in the plaster with an electric saw and the wiring consisted of flat BX cable. About two-thirds of the outlets were located in the tile construction; the remainder of them in concrete construction. Most of the work was done on rolling scaffolds. In some cases, however, job conditions prevented the use of these scaffolds and conventional methods had to be used.

The contractor kept the following accurate labor breakdown for future reference.

CHANNELING PLASTER-This was accomplished by using an emery wheel and an electric saw.

Average time per lineal foot ... 0.09 m. h.

CUTTING FOR OUTLETS-includes cutting the plaster and whatever portion of the tile and concrete construction was necessary for the installation of the outlet boxes. Two-thirds of all the boxes were located in the tile construction.

Average time per outlet..... 0.22 m. h.

INSTALLING WIRE-includes the installation of the flat BX cable after the plaster channeling was completed.

Average time per foot of cable.. 0.07 m. h.

MOUNTING AND FINISHING OUTLETincludes fastening the outlet to the building construction, terminating the BX cable in the box and splicing out the circuits.

Average time per outlet...... 0.30 m. h. Data from Continental Electrical Construction Company, Chicago, Ill.

#### OIL BURNER INSTALLATION

A Yonkers, N. Y., electrical contractor, who has done a number of oil burner wiring jobs, has kept a record of the time it takes to hook up an average burner. The job discussed here consisted of an oil burner installed for a steam heating plant in an old house.

The branch circuit distribution panel was approximately 20 feet from the

The following is the list of material and labor recorded for the complete wiring to and connection of the burner in this particular installation.

MATERIAL USED

30 feet—/2-in. Electric Metallic Tubing
3 feet—/2-in. flexible conduit
25 feet—No. 14, 2-wire BX cable
60 feet—No. 14 slow burning insulated

wire

20 feet-No. 14 rubber covered wire 15 feet-No. 18, 3-wire thermostat cable -split couplings 2—1/2 in. greenfield connectors 6—1/2-in. E. M. T. connectors 4—BX connectors

4-inch square box and cover

-single pole toggle switch on a 3-inch cover -3-inch box -oil burner switch on a 3-inch

plate -/2-inch one hole pipe straps wire nuts

LABOR TO INSTALL MATERIALcovers the complete installation, including running the conduit, BX, mounting switches and connecting circuits to the burner, distribution panel and thermostat.

4.5 m.h. The above figure does not include



NO CHOICE. J. C. Armstrong of Electric Service Co., Knoxville, Tenn., finds he has no choice of manufacturers in certain electrical equipment items. He stocks only the one line because his jobber carries it.

supervisory labor and should be used only as a guide since each individual installation has its own job conditions which must be taken into consideration.

Data from Lawrence Electric Company, Yonkers, N. Y.

#### TOTAL BRANCH CONDUIT

When checking estimates the estimator often wants an independent measure of the branch circuit runs as a check on the rotometer take-off. Average figures from past jobs are of little value because individual jobs will vary so widely.

A handy check is the following calculation. The total required length of the branch lighting circuits may be approximated by the formula:

$$\frac{7\sqrt{AC} + 5C}{6} + R\left(\sqrt{\frac{A}{C}} + 4\right) = T$$

When T = total length

A = ceiling area in sq. ft.

C = number of ceiling outlets R = number of other outlets

For right angled runs or exposed work add 12 per cent to T.

From A. J. Allyn, Chicago.

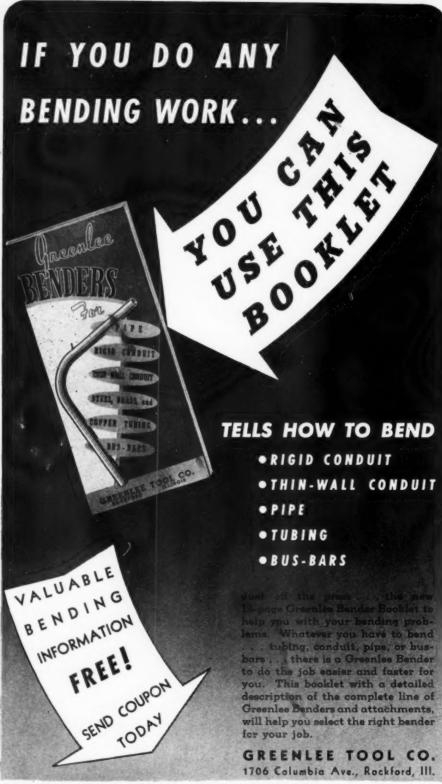
#### SWITCHBOARD **ASSEMBLY**

The main switchboard for a three phase 4-wire 120/208 volt power and light system in a New Jersey manufacturing plant was of the metal clad free standing type. It consisted of a 600 amp., 15-kv. primary oil circuit breaker cubicle complete with hook operated disconnects, utility and owners metering panels and a secondary cubicle containing two 2000 ampere air circuit breakers.

The complete board including all accessories and necessary pull boxes weighed approximately 3,525 pounds net. It was delivered to the job in three sections, the primary cubicle, the metering panels and the secondary cubicle with its pull box. The truck was able to back into the building so the units could be easily unloaded. Then, with the aid of a chain hoist they were raised and set over the anchor bolts precast in the concrete floor. This was necessary only for the cubicles since the two metering panels weighed a total of only 125 pounds and could be easily unloaded and set.

Once the board was set and anchored, the busbar connections were made, conduit extensions installed in the cubicles for the primary and secondary overhead circuits and the underground primary circuit to the outdoor transformer mat.

The contractor kept an accurate breakdown of the labor necessary to unload, set, assemble and test the complete board. The following is the recorded labor data:



SEND ME	TOOL CO., 170 THE NEW GREE	NLEE BENDER	BOOKLET		
Name					
City					
G	R	= /	EN		3 3
HAND	TOOLS	FORT	HE ELE	CTRICAL	WORKER



0

[FROM PAGE 65]

UNLOADING EQUIPMENT — includes the unloading and spotting in place of the 1200-pound primary cubicle, the 2200 pound secondary cubicle and pull box and the metering panels.

Total time ..... 5 m. h.

SWITCHBOARD ASSEMBLY—includes the assembly and anchoring of the two cubicles and two metering panels. Also the necessary conduit extensions, busbar connections and taping in back of the board. Some of this labor was also devoted to spotting the three transformers which were set by others on the outdoor mat.

Total time ...... 29 m. h.

PRIMARY BREAKER CONNECTIONS—includes skinning the four single conductor No. 2/0 varnished cambric lead covered cables and connecting them to the load side of the oil circuit breaker. Also taping all connections.

CHECK OIL CIRCUIT BREAKER — includes filling the primary oil circuit breaker tank, check current transformer trip circuits, oil and set circuit breaker dash pots and ground and test breaker.

Total time ..... 8 m. h.

WIRE METERING PANELS—includes the installation of the meter circuits on the owner's and power company's meter panels. Owner's panel contained a recording watthour meter and one set of test switches. Utility panel contained a recording and an indicating watthour meter, a night rider and two sets of test switches. Also the installation and connection of three current transformers for the owners panel.

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Total time ...... 19 m. h.

The above labor units include supervisory labor on the job.

Data from Garden Electric Co., Inc., Elizabeth, N. J.

#### **GLIMPSES OF OURSELVES**



# WITH PYRANOL TRANSFORMERS

NO VAULTS
REQUIRED—SO
YOU SAVE TIME.
SPACE · MATERIALS

#### SAVE TIME

lt's easy to install Pyranol transformers. Just set them down by the load (or on an overhead beam), run in light-weight primary feeders, and make connections.

#### SAVE SPACE-MATERIALS

Putting the transformers close to the load saves on the cost of secondary feeders. And because Pyranol, the transformer cooling liquid, is noninflammable, out-of-theway installations are easy to make—no fireproof vault is needed.

#### SAVE ON OPERATION

Short feeders between transformers and load mean less drop in voltage, lower losses, higher efficiency. And since Pyranol is non-sludging and chemically stable, upkeep is practically negligible.

Figure out what these savings can mean in your own plant. You'll find, for speedy economical expansion of your power system, Pyranol transformers are a time- and money-saving answer.

#### Other Aids to Overloaded Systems.

#### AIR-COOLED TRANSFORMERS

Like Pyranol transformers, these units can be installed indoors close to the load to obtain greater capacity—plus savings in both time and materials. Particularly adapted to circuits 600 volts and below. Described in Bulletin GEA-897.



#### **PYRANOL CAPACITORS**



If power-factor is low, you can boost wiring capacity 10 to 40 per cent with Pyrenol capacitors. They neutralize reactive (nonworking) current and make room for more load. Moreover, they may save enough in power costs to pay for themselves in one to three years. Described in Catalos GEA-77.

#### AIR-COOLED INDUCTION REGULATORS

Over-loaded circuits mean low voltage and inefficient operation of motors and lamps. G-E air-cooled induction voltage regulators will bring performance back to standard. And indoor installations are easy to make—no vauit is required. Described in Bulletin GES-2285.



Call your G-E representative now for more information on load-center distribution. Ask for Bulletin GEA-2277. General Electric, Schenectady, N. Y.

GENERAL & ELECTRIC

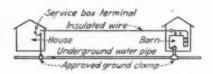


Answered by
F. N. M. SQUIRES
Chief Inspector New York Board of Fire Underwriters

#### Water Pipe As A Conductor

Q. "Would it be permissible to use an underground private water supply pipe as a return conductor when supplying an outbuilding from a farm residence? Both ends of the water pipe in this case being connected by an approved ground fitting.

"The following would be a sketch of what I mean."—C.S.



A. No! That answer should be sufficient but someone may want a definite Code reference on it. Therefore, we find in Section 3005 that only conductors with insulations given in a table in which water pipe is not included are approved for use, except, "for conductors which are not required to have insulating coverings."

The only uninsulated conductors permitted in the Code are, (1) the bare neutral of service entrance conductors, (2) the bare neutral of a service entrance type of cable run to an electric range or as a feeder or service to other buildings from a master service, or (3) a bare conductor feeder.

And in none of these three cases is water pipe given as being permissible.

Therefore waterpipe may not be used as a circuit conductor.

#### Main Service Fuse

1. "Suppose there were four branch circuits on the first floor of a 2-family house and three or four on the second floor, would a main service fuse have to be installed?"—F.R.B.

1. If the service in this case consisted of 2 wires a main service fuse would be required inasmuch as there are seven or eight branch circuit fuses. If, however, the service consisted of 3 wires and there were two sets of fuses (2 fuses in each set or a total of 4 fuses) for the first floor and two sets of fuses (or a total of 3 or 4 fuses) for the second floor, so that the total for the whole house would not be over four sets of fuses and provided the fuses are immediately adjacent to the service switch, then a main service fuse would not be required.

In the second case above a 3 wire d.c. or 3 wire single phase service is assumed.

A set of fuses is, one fuse on a 2 wire service, two fuses (one in each ungrounded wire) in a 3 wire service and would be 3 fuses (one in each ungrounded wire) in a 3 phase 4 wire system.

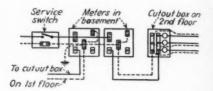


AMPLE STOCK of electrical equipment is kept by D. T. Odom of the D. T. Odom Electric Co., New Orleans, La., for the convenience of his customers. Mr. Odom specializes in industrial and commercial electrical installations and his contracting volume warrants the continuous operation of three trucks.

2. "I could find nothing in the 1940 Code that would prohibit a 2-family house being wired as shown below (with no service fuse) and a pair of feeders run from each meter in the cellar to a cutout box on each floor (with 3 branch circuits for each floor), yet there would be no protection for the feeders.

"This does not seem right as it would be very easy for a short circuit to develop in a 35 ft. run of BX which would not be protected. What is your

opinion?"-F.R.B.



2. Section 2372 of the 1940 Code (same in the 1937 Code) requires that the "Service overcurrent device shall be an integral part of the service disconnecting means or shall be located immediately adjacent thereto." This rule applies whether the service fuse is a single fuse of a "set" of fuses or "sets" of fuses not in excess of six.

Therefore, where the distribution boxes are located away from the service switch, as would be the case if they were located on the first and second floors, a main service fuse is required.

#### Maximum Size Motor on Lighting Circuit

Q. "What is the largest motor that can be connected to a lighting circuit?"—E.R.W.

The maximum size of a motor which can be used on a branch lighting circuit depends upon whether the motor is fixed or portable as well as on the classification of the circuit on which it is to be used.

The following is based on the presumption that there are also lights on the

branch circuit.

Then, on a 15 ampere branch circuit, if the motor or motor-operated appliance is fixed, a 6 amp. motor is the largest individual motor or two or more motors with a total rating of not more than 6 amperes (see 2125C1). If the motor is portable the largest individual motor permitted would be one with a rating of less than 12 amperes (see 2125b2) in order that there shall be some capacity left for the lighting, as a 12 ampere motor would require 12



BOTH 48" and 60"

### MAZDA Pluorescent TWIN-LAMP Lighting Units

#### NOW BUILT TO RLM SPECIFICATIONS

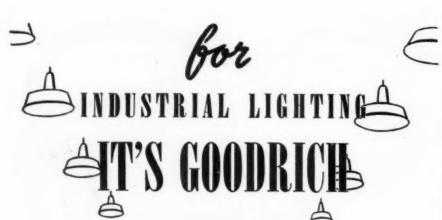
• Your continued success in capitalizing the new marketing opportunities opened by Fluorescent Lighting depends on each purchaser getting maximum performance and economy from this new light source. This customer-satisfaction depends, to a very large degree, upon basic design and construction factors . . . not readily discernable without exacting laboratory and engineering tests.

When you push Fluorescent Lighting Units bearing the RLM LABEL, you assure yourself of a satisfied customer. Furthermore, selling is easier because lighting fixture buyers and specifiers everywhere recognize that RLM labeled lighting units are certified by Electrical Testing Laboratories to comply with exacting specifications that assure: (1) More Light at No Extra Cost; (2) Balanced Lighting; (3) Low Replacement and Maintenance Cost; (4) Uniform Quality.

AVAILABLE SOON 3-LAMP-48" Fluorescent Unit ALZAK ALUMINUM Fluorescent Unit

The Letters RLM Stand for Reflector and Lighting Equipment Manufacturers









Goodrich makes all styles including R.L.M.-approved fixtures to meet the most exacting indus-

trial requirements. Where permanence is required, Goodrich fixtures are finished in porcelain enamel.



#### **FLUORESCENT**

FIXTURES—for high intensity industrial illumination. Many new styles include fixtures for the 100-watt fluorescent lamp.



#### DISKONECT

—the simplest, detachable reflector ever made. Attached or detached in an instant by means of a simple snap lock.



#### THE STOCKLITE

—for correct illumination of shelves and bins in narrow stockroom aisles. Directs light where

needed—eliminates aisle glare—speeds work.



#### **FLOODLIGHTS**

—for uniform illumination of outdoor areas: a wide selection of styles

for long and short range lighting; available for pole or bracket mounting.



#### **STANDLITES**

—widely used by gasoline service stations, in parking lots, on drive-

ways, station platforms, in fact the industry's most popular fixture for this kind of service.

The above are but a few popular fixtures from the complete Goodrich line. No matter what your industrial lighting requirements may be, Goodrich has the answer. Literature is available on all Goodrich fixtures.

SOLD ONLY THROUGH ELECTRICAL WHOLESALERS



GENFRAL OFFICES AND FACTORY: 4602 BELLE PLAINE AVENUE, CHICAGO, ILL.



FROM PAGE 481

amp. × 125 per cent which equals 15 amperes or the full permissible load of the circuit without any to spare for lighting.

On a 20 amp, branch circuit motors both fixed and portable are limited to not more than 15 ampere rating by 2135b2 and 2135C1.

On a 25 ampere branch circuit motors are limited to 20 amperes and on a 35 ampere branch circuit to 25 amperes.

Motors are not permitted on a 50 ampere branch circuit with other loads but only on an individual branch circuit of that rating.

#### A Wet Location

Q. "We are wiring a number of buildings which are to be occupied as apartments and dwellings.

"The foundation walls are made up of concrete hollow tile and the first floor concrete slab is approximately 3 ft. above grade with air ventilators which permits the free movement of air under this slab, and the rooms above this slab will be used for living quarters.

"In your opinion, would you consider this a moist location as defined in Chapter 3, Article 300, Paragraph 3035?"—D.R.R.

A. No. The National Electrical Code requires that lead covered or type R.W. wire be used when a raceway is installed.—

- a. Underground, that is buried in the earth,
- In concrete slabs or other masonry in direct contact with the earth,
- c. In wet locations.
- d. Where condensation and accumulation of moisture may occur.

In the case cited in the question the concrete slab or flooring is not in direct contact with the earth but is three feet above it with a ventilated air space between the slab and the

While the 1937 Code did not supply a definition of wet locations, one has been provided for in the 1940 Code as follows:—

"Wet location: A location subject to saturation with water or other liquids, such as locations exposed to the weather, wash rooms in garages and like locations. Installations underground or in concrete slabs or masonry in direct contact with the earth shall be considered as wet locations."



## **GENERAL CABLE**

BARE and INSULATED WIRES and CABLES for EVERY ELECTRICAL PURPOSE

Stocked by Electrical Wholesalers Everywhere

General Cable Corporation Sales Offices: ATLANTA - BOSTON - BUFFALO - CHICAGO - CINCINNATI - CLEVELAND - DALLAS - DETROIT - HOUSTON KANSAS CITY (MO.) - LOS ANGELES - NEW YORK - PHILADELPHIA - PITTSBURGH - ROME (N.Y.) - ST. LOUIS - SAN FRANCISCO - SEATTLE - WASHINGTON (D.C.)



#### GOVERNMENT SPENDING ON ELECTRICAL WORK

Some interesting figures have come out of Washington on the money that is being spent for electrical work on mass housing

and army shelter projects.

Available appropriations for defense housing total \$240,000,000, which is expected to be enough for between 65,000 and 70,000 dwelling units. On the early projects where overhead distribution systems are built the cost runs about \$35 per unit for distribution facilities and roughly another \$35 per unit for interior wiring and fixtures. Some projects, mostly near the airports, will have underground distribution which will cost upwards of \$70 per

It is estimated that shelter for army trainees will cost \$631,000,000. A round figure estimate of the electrical sub-contract is \$125,000 for camp housing one division. This figure holds whether it is frame barrack or tent construction. There have been camp projects for about 30 divisions announced. In addition, there are at least 13 army reception centers for new recruits where electrical installation will figure at around \$65,000 each. The Defense Commission publicity division the other day, in a release reporting a breakdown of the \$2,000,000,000 defense construction program, estimated electrical construction at \$40,000,000. But just what is covered by this figure is not divulged.

#### SPECIAL N.F.P.A. COMMITTEE MEETS

unit.

On December 2nd the special N.F.P.A. Committee for Drafting Model Electrical Law met in Chicago and made their final recommendations for revision of the draft of a proposed State Law for Electrical Inspection. This had received substantial majority approval of the subcommittee last year and which was acted upon at the N.F.P.A. meeting in Atlantic City in May 1940 and referred back to the special committee for final revision and submission for consideration by the N.F.P.A. in 1941.

The special committee were in agreement on the adoption of the draft of this state law as now revised and it has been

referred to the Laws and Ordinances Committee of N.F.P.A. for their consideration and recommendation to the N.F.P.A. parent body.

George Andrae, Chairman of the NECA Codes and Standards Committee, represents NECA on this N.F.P.A. Committee.

#### APPRENTICE TRAINING CONFERENCE

E. H. Herzberg, Executive Manager of the Milwaukee Chapter, NECA, who has been appointed as Chairman of the NECA Apprentice Training Committee, succeeding J. W. Collins of Chicago, attended the Round Table Conference on Apprentice Training held in Washington on December 5th and presented the objectives of his committee to the construction industry conferees gathered at that meeting.

This round table conference on Apprentice Training was one of the important features of the two-day Construction Industry Conference held under the joint sponsorship of the Chamber of Commerce of the United States and the Producers Council. Speakers at the round table conference on Apprentice Training included representatives of both employers and

labor from each of the principal branches of the construction industry.

On December 10 Secretary Perkins appointed E. H. Herzberg as a member of the General Committee on Apprenticeship for the Construction Industry, which is made up of an equal number of representatives from unions and employers to cooperate with the Federal committee on apprenticeship in developing the program in the construction industry.

During his visit to Washington Mr. Herzberg discussed the apprentice training program with E. J. Brown, International President of the I.B.E.W. and Wm. F. Patterson, Chief of Federal Committee on Apprenticeship, Department of Labor. The importance of active promotion of apprentice training throughout the country in the light of the increasing need for skilled labor under the national defense program was studied.

#### DENTON COMMISSIONER OF SAFETY

Following his return to Kansas City last July, A. Penn Denton, consulting engineer, formerly with the Conduit Association in New York City, established his headquarters as a consulting engineer specializing in Codes and Standards work, with particular attention to the revising of Municipal electrical codes.

Mr. Denton, who is well known in the electrical industry, was recently appointed Commissioner of Safety and Inspection for the city of Kansas City, Missouri. This is a newly created position authorized by a recent city council ordinance. In this capacity Mr. Denton has supervision over all inspection of building work, including construction, electrical, plumbing, elevator, boiler and smoke, gas meter, gasoline pump and filling stations, weights and measures and street lighting. At present he is busy supervising the reorganization of the local electrical department and electrical and building codes.



GOOD SELLING—These contractors bring cheer to the city of Casper, Wyo., each Christmas. Under the auspices of the Casper Electrical Contractor's Association an appropriate outdoor Christmas scene is built and lighted for the entire month of December. Left to right are Don Germond, secretary; F. R. Peebles; Mark Rowley, president; A. L. Forster and A. W. Thiele who comprise the lighting committee. As a result of their work the entire town lights up for Christmas.

# **Armored Cables**

For Safer and More Convenient Installation

## HAZARD ARMORED THERMOCABLE

has heat-resisting rubber insulation on each conductor, colored for identification, and armored for mechanical protection. Insures positive operation of control apparatus for heating and air conditioning systems and units.

## HAZARD ARMORED CABLE, TYPE AC

has a flame-resisting, moisture-proof paper sheath between the conductors and spiral interlocked steel armor. A ripcord beneath the paper facilitates installation. The insulating bushing is inserted at cut ends over paper sheath.

## HAZARD ARMORED GROUND WIRE

with tinned copper conductor without insulation, armored for protection. The armor makes grounding assurance doubly sure.

## HAZARD FLEXIBLE STEEL CONDUIT

is offered as a single unit. This strong but flexible conduit saves time and expense for short runs, or where many bends must be made.

A complete line, stocked by Electrical Jobbers. Hazard Insulated Wire Works, a Division of The Okonite Co., offices in principal cities.





[FROM PAGE 72]

## EXECUTIVE COMMITTEE TO MEET IN FEBRUARY

The mid-winter meeting of the NECA Executive Committee will be held at National Headquarters in New York City on Monday, February 3, 1941. The Labor Relations Committee of the Association will hold its meeting on the preceding day.

## N. J. LEAGUES ELECT OFFICERS

The various sectional league members of the New Jersey Council of Electrical Leagues recently held their annual meetings for the purpose of electing officers to guide their affairs during 1941.

Thomas M. Hunter, president of the American Transformer Co., was elected president of the Essex Electrical League succeeding William A. Shaw, contractor. Mr. Shaw is now a delegate to the N. J.

Council of Electrical Leagues. Edward Heidt was named vice-president; Joseph Buhl, treasurer and J. H. Stapleton was re-elected secretary of the Essex group. The Maintenance Division of the Essex

The Maintenance Division of the Essex League elected John Amos, National Lead Co., president; William Craig, Lehigh Warehouse & Transportation, vice-president. Andrew Jacobus, Crucible Steel Co., was named treasurer and Arthur Post, S. Hird & Sons Co., secretary, Herbert V. Weeks, Crucible Steel Co., is the retiring president of this division.

In the Central Jersey section, the Industrial Maintenance Association, Central Electrical League, elected these officers at its recent meeting. S. G. Szabo, Ternstedt, Trenton Division, president; Uriah Pittman, Hamilton Rubber Co., vice-president; E. S. Weed, Wm. R. Thropp & Sons Co., treasurer and Ronald T. King, Public Service Electric & Gas Co., secretary.

## REA RESEARCH FINDS CHEAPER SERVICE METHODS

Speaking before the American Society of Agricultural Engineers in Chicago on December 5, M. M. Samuels, chief re-



OFFICE MANAGER G. L. Thomas, of the Electric Motor Repair Co., Waterbury, Conn., returned to work after recently joining the ranks of the benedicks and found his company swamped with orders from the defense industries. This company does about 90 per cent of the motor work in the city.

search engineer of the Rural Electrification Administration announced several new developments, a new one kva. transformer, a new combination meter and circuit breaker service unit, a ground testing instrument and a new ground fitting.

A one kva. transformer with 10 watt core loss or less with 3.8 per cent regulation has been developed that will cost about \$25 which compares with an average price of \$40 and an average core loss of 24 watts for a 1½ kva. service transformer.

"After line cost has been reduced, it was found that REA cooperatives could furnish distribution cabinets as part of the line construction cost, making it unnecessary to charge it to the cost of house wiring. The new device combines the meter, meter socket and service box, using circuit breakers, in one unit," he said. An REA engineer has developed a ground testing meter now under production which will go on the market at \$27.50. The meter is direct reading and indicates the position of the ground connection. A new ground fitting which permits convenient disconnecting for testing ground resistance, has also been developed.

## GOULD HEADS COOK COUNTY CONTRACTORS

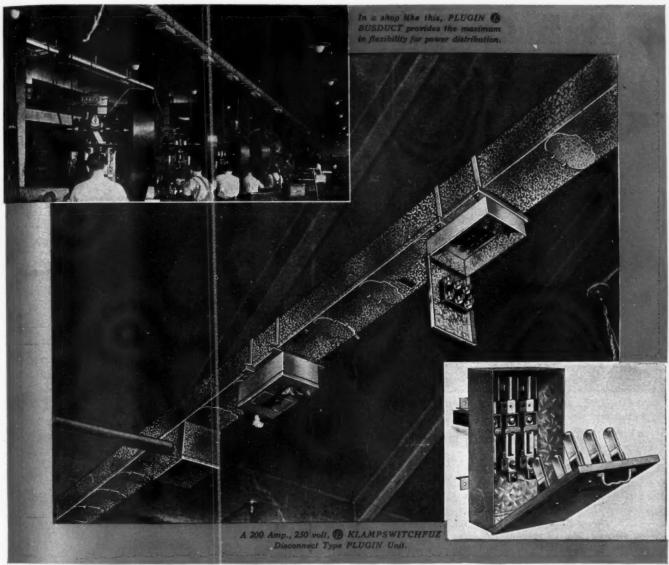
Elton A. Gould, Jr. was elected president of the Cook County (Chicago) Electrical Contractors Association for 1941 at the annual election of officers held on December 9th in Chicago. William J. Templeman, retiring president, becomes a member of the Executive Committee.

Other officers elected were: Edward H. Wigdahl, vice president; Arthur L. Simons, secretary, and Henry Bell, treas-

Board of Directors elected were: Frank



"I think we should'a had a electrician install this kitchen fan, Paw—somehow this don't seem right!"



## Move the machine-plug in-go!

It's as simple as that when the plant is equipped with Plugin @ Busducts. The easily-accessible outlets, conveniently spaced, make it possible to place machines at any desired location — to plug in quickly—and to commence operation without delay. With Plugin @ Busducts, use Feeder @ Busduct to provide ample capacity for present and future power requirements.

## This is the Modern Way!

This is the compact, flexible and convenient method for power and light distribution. The busducts may be attached to either walls or ceilings. Flexibility is provided by suitable elbows, tees, end boxes, intermediate feed-in and feed-out boxes—all adapted to fit required space or position. Future extensions may be made readily to existing installations.

Busducts—both Feeder and Plugin types—are made in standard 10-foot sections. Each section of the Plugin type is arranged with nine plug-in outlets on 12-inch centers. The copper bus bars (contained in enclosures of galvanized steel or aluminum) are rigidly supported at 30-inch intervals by specially designed insulators that assure proper spacing—to meet requirements of the National Electrical Code. Contact surfaces of connecting bars are silver-plated, to prevent oxidation. For 2, 3 and 4-wire feeder systems; 250 volt DC, 575 volt AC, maximum.

#### Sales-Engineers Can Help Manufacturers, Architects, Engineers and Contractors With Their Distribution Problems

Their long experience and training are at your service—without obligation. Write for the name and address of the one nearest you. Also, for Bulletin 61, which contains complete descriptions, applications and detail drawings of Busducts... Frank Adam Electric Company, St. Louis, Mo.



## RHEOSTATS On the Hews EVERY JOB





The Ward Leonard Pressed Steel Plate Type Rheostat is a most adaptable control device. It lends itself to front or back of board mounting, multiple deck assembly, concentric operation, and manual or motor drive. Thus, whatever the control requirements or method of operation may be, Ward Leonard, with their wide range of

rheostat mountings and accessories can give you on short notice the exact combination to do the job.

Plate Type Rheostats are described in Bulletin 60. Ring Type Rheostats in Bulletin 1105. Laboratory Rheostats in Bulletin 8002. Send for Bulletins of interest to you.

## WARD LEONARD ELECTRIC COMPANY

Electric Control Devices Since 1892

Ward Leonard I	Electric Co., 28 South Str	reet, Mount Vernon, N.	Y.
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City	St	ate	



FROM PAGE 741

M. Block, Block Electric Co.; Emil De-Haan, Service Electric Shop; Joseph Kunst, Principle Electric Co.; Albert Leavitt, Malko Electric Co.; John F. Lenc, Richmond Electric Co.; Edward L. Reeve, Reeve Electric Co.; and George W. Reinke, G. W. Reinke Electric Co.

Herbert Binner continues as Executive Secretary of the organization, with head-quarters at 160 N. LaSalle St., Chicago.

The formal induction of officers will be held on January 13.



CRITICAL, Ray Hornbeck of T. H. Green Electric Co. of Rochester, N. Y., studies stator coils produced on modern coil winding equipment. "It is a far cry", he says, "from the days when we used to rewind Edison bi-polars."

## **NEW NECA CHAPTER**

A charter has been issued by NECA for a new Chapter of 21 members of National Electrical Contractors Association in St. Louis, Mo. G. L. Gamp is President of this St. Louis Chapter, NECA, and R. E. Vierheller is Business Manager.

## PAGELS HEADS WISCONSIN IAEI

Erwin L. Pagels, Whitefish Bay building inspector, is the new chairman of the Wisconsin Chapter of the International Association of Electrical Inspectors. Other members of the executive group are Glen Fiedler, Green Bay, vice-chairman, and John E. Wise, Madison, secretary.

## **NECA CONVENTION** IN HOUSTON

The NECA Convention at Jacksonville voted unanimously to hold the 1941 convention in Houston, Texas, but left the selection of the dates and the convention hotel to NECA officers.

# This "Best-Seeing" Light for your customers is the "Best-Paying" Light for you



LUORESCENT lighting must pay the user a profit. This business is just that simple. And that's why the news about IVANHOE "50 FOOT CANDLER" should make so much sense to you. It is the first RLM continuous fluorescent lighting system providing 50 foot candles of general illumination. This is the illumination authorities prescribe for "best-seeing" conditions for most lighting needs. And even higher lighting levels can be readily worked out where desired.

This "best-seeing" light is your customers' "best-paying" light because of consistent performance; greater illumination at no increase in cost; economical installation, maintenance and operating expense...with a plus factor for future growth. It's your "best-paying" light, too ... because you sell more and better lighting for less cost ... secure more jobs through installation economies. "50 FOOT CANDLER" puts you in the picture at the planning stage ... takes you out of competition with individual package units.

Call on us now for full details about the "50 FOOT CANDLER", and call on us at any time for other product data, or for help on any job, large or small. WRITE . . .

THE MILLER COMPANY, Meriden, Conn. Pioneers in Good Lighting Since 1844

### A COMPLETE LIGHTING SERVICE

In addition to Ivanhoe RLM Continuous Fluorescent Lighting, Miller offers a complete line of metal reflectors, lighting glassware and fixtures utilizing filament and mercury vapor lamps for all industrial and commercial lighting requirements. A complete lighting service — therefore an unbiased lighting service.

Investigate New MILLER FLUORESCENT TROF-FERS, Too... Companion-piece to the "50 Foot CANDLER," MILLER TROFFERS represent the most advanced form of continuous recessed fluorescent trough lighting. Ideal for acoustical or other hung ceiling constructions. Write for new Troffers bulletin Sec. 2G.

"50 FOOT CANDLER"



RLM Continuous fluorescent lighting

MILLER is off to a flying start in '41 with an intensive business paper advertising program reaching owners, executives, managers and maintenance men in industrial and commercial establishments and institutions . . architects and engineers . . building owners and managers . . public utilities . . etc. All this plus keyed direct mail, engineering literature and special merchandising. Work with this campaign, and watch it work for you!

41

# AMERICAN INDUSTRY Guthe Hews **DEMANDS THE BEST!**





Write for complete bul-letin giving detailed in-formation on the new MITCHELL No. 2026 In-dustrial Unit.

corrected. Unit is superbly engineered and rigidly constructed of heavy-gauge prime vitreous steel, in blue-black external finish. Reflector has 3 coats of finest high-reflecting vitreous porcelain enamel. Design provides proper light control with 14° angle of shielding; porcelain reflecting surface has 79% reflection factor; light output efficiency is 95%. For 110-120 volts, 60 cycles AC. Fleur-o-lier and Underwriters' Approved. MITCHELL—a great name in Fluorescent lighting —manufactures a complete line of quality Fluorescent Fixtures for every type of industrial and commercial application. These are sold only through Franchised MITCHELL Lighting Division Distributors. For full details, contact your nearest MITCHELL Distributor.

MITCHELL Fluorescent Units bear the Fleur-o-lier Label—your assurance of Certified Fluorescent Qual-ity.

MITCHELL MFG. CO.

"A Great Name in Lighting"



**IFROM PAGE 761** 

Announcement is now made that the Rice Hotel in Houston has been selected for convention headquarters and the dates are set for Monday, Tuesday and Wednesday, October 6, 7 and 8. J. S. Copeland, President of the Houston Chapter, NECA, announces that his committees are already making plans for this 1941 convention and that they will sponsor an electrical manu-facturers' exhibit as a feature of the convention. The Rice Hotel is one of the largest in the southwest, with ideal facilities for handling every feature of the con-

#### COMING MEETINGS

New York Electrical Trade Show—Second An-nual, Hotel New Yorker, New York City, February 5-8.

Wisconsin Electrical Association — Annual Meeting, Hotel Schroeder, Milwaukee, Wis., February 14 to 15.

National Electrical Manufacturers Associa-tion — Mid-Winter Conference, Palmer House, Chicago, Ill., February 17-21.

Minnesota Electrical Council, Minnesota Electrical Association, North Central Associated Electrical Industries—Winter Convention, Hotel Albert, Albert Lea, Minn., February 20–22.

## NO BOSTON SHOW IN '41

The Electrical Manufacturers Representatives' Club of New England voted, at a recent meeting in Boston, to omit the Annual Trade Show in 1941. The consensus of opinion of a majority of those present was that, under the pressure of defense work, most manufacturers have taxed production lines, are deluged with back orders and hence would find it im-



INCREASED BUSINESS is being enjoyed by F. W. Steffner, manager of the Knoxville, Tenn. branch of the Southern Armature & Motor Works which has its main office in Chattanooga. Much of this work is due to the increased use of electricity in the TVA

OUTLET DESERVES

BRYANT DEVICE



## Ceiling SWITCHES

These are the "tough job" switches. They operate large banks of high-wattage lamps in industrial and commercial installations. . . A Bryant ceiling switch can take it! Its mechanism is extra durable. The bakelite cover is non-corrosive. The link between mechanism and pull cord is a bead chain that resists both fumes and wear. For information on types and prices for all jobs, see your Bryant Catalog No. 40, or write the nearest Bryant office.



THE BRYANT ELECTRIC COMPANY **Bridgeport, Connecticut** 



SOLD THROUGH ELECTRICAL WHOLESALERS NATIONALLY

Since 1901 a subsidiary of WESTINGHOUSE **ELECTRIC & MANUFACTURING COMPANY** 

# FOUR POINT ECONOMY—



Above: Type CFT, threephase, outdoor-type, airc o o l e d, general-purpose transformer.

Below: Type CF, Single-phase, outdoor-type, air-cooled, general - purpose transformer.



LOW INITIAL INVESTMENT

EASY TO INSTALL

NSTALI R

MINIMUM MAINTENANCE

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EFFICIENT IN OPERATION

Whenever it is desired to obtain a low-voltage supply from a higher voltage circuit you will find AmerTran Type "CF" Air-Cooled Transformers both economical and convenient to use. These moderately priced units may be installed wherever they are needed—either outdoors or indoors\*—without the necessity of oil, fire-proof vaults or enclosures. All sizes are equipped with either conduit fittings or a built-in junction box to facilitate installation, and both single-phase and polyphase types are furnished as a single unit. Available in capacities up to 100 Kva. and for potentials up to 2400 volts, all ratings offer low initial investment, minimum installation and maintenance expense, and low operating cost. Let us send data on equipment to meet your needs. Ask for bulletin 1116A.

\* Units rated 15 Kva. and larger for indoor service only.

## Type "CF" Applications

- Stepping down power circuit voltage to 115/230 volts for lights, small motors or fleating elements. In this way advantage may be taken of lower power rates for low-voltage loads.
- 2. Obtaining a 3-wire circuit from a 2-wire system.
- Changing from 3 phase to 2 phase, or vice versa, on a power system.
- Obtaining low voltage for heating, welding, 32-volt tools, special lighting, testing, etc.
- 5. Balancing load on 3-phase
- 6. Insulating one circuit from
- Distributing power at 600 volts or less.
- 8. Reducing light flicker.
- Obtaining special voltages to permit efficient operation of equipment.

PRODUCTS

American Transformer Co. manufactures transform-

ers for every industrial,

electronic and laboratory

application in sizes up to 10,000 Kva and for poten-

tials up to 132 Kv. Other

products: voltage regula-

tors, test sets, rectifiers.

# AMERICAN TRANSFORMER COMPANY

178 Emmet St.

Newark, N. J.

# AMERIRAN

Manufactured Since 1901 at Newark, N. 1 RANSFORMERS

In the Hews

FROM PAGE 781

possible to make deliveries on any of the new products and developments ordinarily exhibited at the show.

## CONTRACTORS RE-ELECTED

Howard L. Miller, president, Utilities Engineering Co., and Sylvan W. Drucker, president, Independent Wiring Co., Inc., were recently re-elected to represent the electrical contractors on the Board of Governors of The Electrical Association of Philadelphia. Mr. Miller, who was re-elected chairman of the Contractors Division, is completing his third term as vice-president of the Association.

## WISCONSIN STANDARDS UP

The wiring standards of the Wisconsin Electrical Code have recently been increased. The requirements now call for No. 12 wire for all circuits supplying current to outlets in the kitchen, dining room and other rooms where motors and appliances are used. The code also requires each circuit to be protected with a 15-ampere fuse.

## DAMERON NOW AN INSPECTOR

G. V. Dameron, former electrical contractor of Kansas City, Mo., has recently been appointed Chief Electrical Inspector of Kansas City.

Mr. Dameron has been in the electrical contracting field for 35 years, 27 of which were devoted to his own business. He is a past-president of the local electrical contractors association and one of the organizers and active members of the Adequate Wiring Club in this city.

## CONTRACTORS ACTIVE IN PROMOTION

Thirteen electrical contractors of Philadelphia, Pa., took their initial plunge in a lighting promotional program, when they recently actively participated in a Lighting Campaign sponsored by the Electrical Association of Philadelphia. This is the first time the missing link of total support was forged, completing the industry chain of utility, manufacturer, wholesaler and contractor.



# AUTOMATIC ELECTRIC

PRIVATE INTERIOR TELEPHONE SYSTEMS

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Sales and Service Offices in Principal Cities

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Check if an electrical contractor or dealer.



[FROM PAGE 80]

## BOOK REVIEWS

#### National Electrical Code Handbook

National Electrical Code Handbook

This fifth edition of the handbook, based on the 1940 edition of the National Electrical Code, is entirely revised and embodies all the changes and additions in the new Code. It restates and explains the code rules in simple language, giving practical examples of their application.

Special grouping of the rules makes it easy to locate all the regulations relating to a specific job. This grouping is divided into six parts with a total of thirty-seven chapters including tables. Has a subject and cross index. Part I covers Definitions; Part II, Approved Types of Wiring; Part III, Installation of Materials and Apparatus; Part IV, General Requirements for All Wiring Systems; Part V, Special Installations and Equipment; Part VI, Construction of Materials, Tables and Indices.

The handbook presents the reader with a clear concise picture of the meaning and application of the National Electrical Code and is intended for general use as a reference book by the contractor, maintenance man, engineer or anyone interested in the design and installation of electrical systems and equipment; also as a textbook for individuals and classes making a systematic study of the Code. National Electrical Code Handbook, Fifth Edition. By Arthur L, Abbott. 595 pages; 5 by 7½, numerous wiring diagrams and illustrations. Semi-flexible binding. Price \$3.00. McGraw Hill Book Company, 330 W. 42nd St., New York, N. Y.

#### Photo Relays

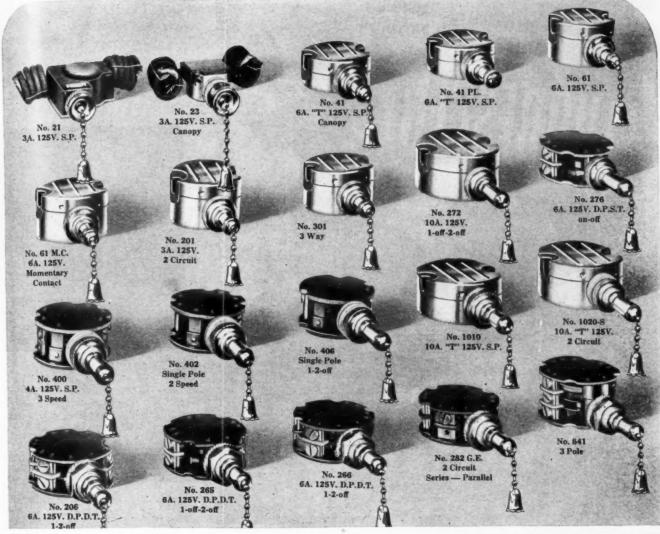
This book, written by a consulting engineer in the electronic application field, gives a clear concise discussion on the theory and application of photo relays. The text is divided into five chapters covering photoelectric phenomena, amplifiers, glow discharge tubes, light sources, and applications. Chapters are illustrated with charts, wiring diagrams and photographs.

Presented in simple language, this information should be of interest to electrical contractors, engineers, plant men and anyone who has occasion to specify or use photo electric relays. Photo Electric Relays, Their Theory and Application By F. H. Shepard, Jr., Consulting Engineer Electronic Applications. 28 pages; 6 by 9. Paper bound. Price, 25 cents. Allied Control Company, Inc., 227 Fulton St., New York, N. Y.

# Manufacturers

## George Cullinan Retires

George E. Cullinan, senior vice-president of the Graybar Electric Company, retired on December 31, 1940, after 39 years of active service in that organization and a long period of leadership in the wholesale branch of the electrical industry. Mr. Cullinan was chairman of the National Electrical Wholesalers Association and also on the executive committees of the National Electric Light Association and the Society for Electrical Development.



## M¢GILL Levolier

## A Switch for Every Fluorescent Lighting Problem

Don't risk your reputation or that of the Fluorescent Lighting Manufacturer by installing anything but the best in switches. To replace a switch in a Fluorescent fixture is expensive and troublesome. With McGILL Levolier Switches dependability is assured, for back of each switch are years of experience and an unsurpassed record for troublefree operation in practically every type of installation.

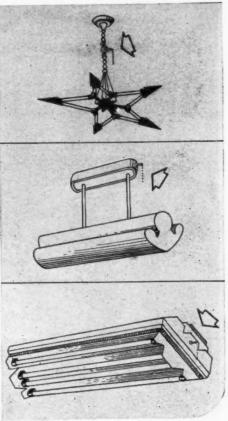
## McGILL Levolier Switches In Use Today In Fluorescent Units

No.	Amp.	Volt	Control
39	6-A	125-V	link type, on and off
41	6-A	125-V	on and off
1010	10-A	125-V	on and off
276	6-A	125-V	on and off double pole
1020	10-A	125-V	lights any two tubes, or all four, and off
1029	10-A	125-V	link type—lights any two tubes, or all four, and off
1039	10-A	125-V	link type, on and off

McGILL Levolier Switches - Recommended by many leaders in the Fluorescent Lighting Field, some of which we are listing below:

Goodrich Electric Company, Chicago, Illinois Garden City Plating & Mfg. Co., Chicago, Ill. Art Metal Company, Cleveland, Ohio DayBrite Lighting, Inc., St. Louis, Missouri Benjamin Electric Mfg. Co., DesPlaines, Ill.

#### MIGILL MANUFACTURING COMPANY VALPARAISO, INDIANA Electrical Division







[FROM PAGE 82]

In 1930 he received the James H. McGraw Award "for persistent and unselfish labor for the education of the



GEORGE E. CULLINAN

industry in the economics of distribution." Mr. Cullinan has been in poor health for the past two years but is now fortunately on the mend.

## **Rockbestos Changes**

Rockbestos Products Corporation of New Haven, Conn., has made the following changes in its personnel:

P. O. Weston, formerly manager of the St. Louis sales office has been put in charge of the new Pacific Coast sales office. His headquarters are 367 Ninth Street, San Francisco, Calif.

J. T. Williams, who was formerly with the Chicago office, has been promoted to the post of St. Louis territory manager.

Carle Vande Bogart, formerly with the Detroit office, has been transferred to the Chicago sales office to replace Mr. Williams.

J. O. Pease has been transferred to the Detroit office from the New England territory.

R. G. Newton of the New Haven sales office has been assigned to the New England territory.

## **Westinghouse Promotions**

Westinghouse Electric & Manufacturing Company has appointed H. V. Putman as manager of the transformer division, succeeding M. L. Fawcett, who has been transferred to the Pittsburgh headquarters of the company as staff assistant to the general works manager. Mr. Putman was formerly manager of engineering at the Sharon, Pa., works.

J. K. Hodnette has been made manager of transformer engineering at the Sharon works, succeeding Mr. Putman.



# There's literally no <u>limit</u> to profit opportunities on <u>superior-quality</u> **HYGRADE MIRALUMES!**

1. THEY'RE EASIER TO SELL! Hygrade MIRALUMES offer your customer a combination of advantages not found in any other fluorescent lighting fixtures . . . finer light (produced by Hygrade's patented lamp coating) . . . quick, trouble-free starting and longer lamp life (assured by Hygrade's patented Mirastat starters) . . . lower maintenance (Hygrade's one-piece easily demountable reflector and patented lamp holders) . . . performance that's more dependable at all times!

2. THEY'RE EASIER TO INSTALL! Hygrade MIRALUMES are complete fixtures, corrected for power factor and stroboscopic effect, supplied wired and ready to install. Every MIRALUME is thoroughly pre-tested (with lamps) before shipment, so you don't have to make costly callbacks.

## 3. THEY'RE SURER TO SATISFY!

Hygrade MIRALUMES are quality manufactured—better designed and engineered throughout—approved by Underwriters Laboratory. Customer satisfaction is assured by HYGRADE'S complete guarantee on the entire fixture—lamps included!

**WRITE TODAY** for information, prices, discounts on MIRALUMES. Address: Dept. EC1, Hygrade Sylvania Corp., Ipswich, Mass.

NOTE—Amazingly superior lighting results are obtained in Hygrade Fluorescent Lamps by tuning the electric discharge to concentrate its ultra violet energy at the precise 2537 Angstrom Unit wave-length most effective in causing the porous film (Hygrade patent 2,096,693) to generate a revolutionary new kind of light. The development of the electrical discharge used in this extraordinary new type of lighting resulted in patents 2,126,787 and 2,201,817, now controlled in this field by Hygrade.

new type of lighting resulted in patents 2,120,767 and 2,207,017, the lint his field by Hygrade.

Hygrade Miralumes incorporate the additional advantages of the high power factor, low stroboscopic circuit described in Hygrade patent 2,195,114 and the quick, trouble-free starting described in Hygrade patent 2,195,115. Practical design features that meet the specific needs of industrial and commercial light users are described in Hygrade patents D-120,563, D-122,145, D-122,236 and D-122,903.



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Hygrade Miralumes

HYGRADE SYLVANIA CORP., EST. 1901. MAKERS OF HYGRADE INCANDESCENT LAMPS AND WORLD-FAMOUS SYLVANIA RADIO TUBES

## TIREX

## helps your Safety Record

SIMPLEX-TIREX SINGLE 2-133 LOCOMOTIVE 600 V

All stock sizes of TIREX Cords and Cables now have a permanent marking molded onto the "selenium rubber armor." These markings not only identify the cord or cable as Simplex - TIREX but also show the size, number of conductors, type and voltage rating of the cable.

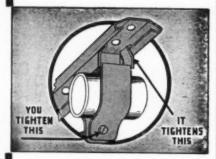
Here is a further example of the quality and thought put into the construction of all TIREX Cords and Cables. The seine twine reinforcement, the "selenium rubber armor" and now the new complete markings are all evidence that TIREX is made for greater safety and efficiency. The stock sizes of TIREX are given in complete detail in the latest edition of the TIREX catalog. We will be glad to send you one upon request.

## SIMPLEX WIRE & CABLE CO.

79 Sidney Street, Cambridge, Mass.

With Only One Screw to Tighten

THE CLEVELAND CONDUIT HANGER



Gives You a Quicker Easier Installation

"CONVINCE YOURSELF"

"Sead for Circular Giving Full Details"

THE CLEVELAND SWITCHBOARD CO. 2727 E. 79 St. Cleveland, Ohio

SOLDERLESS CONNECTORS

The New Ilsco Lugs?



## BUILT FOR OVERLOADS!

The new design — as passed by the Underwriters' Laboratories May 1, 1940.

Write for Samples today,
—Along with the New
Catalog.

.....No Obligation.....

ILSCO COPPER TUBE AND PRODUCTS, INC. 5629 MADISON ROAD CIN., O.



FROM PAGE 841

Edwards and Company of Norwalk, Conn., announces the appointment of Midwest Equipment Company of 215 South Twelfth Street, Omaha, Nebraska to handle the sales of its line in Nebraska and the Western part of Iowa. This office is in charge of A. V. Sorensen. A branch of the Midwest Equipment Company is located in Des Moines, Iowa, which office is in charge of F. J. Reinacher.

John A. Roebling's Sons Company, Trenton, N. J., has announced the appointment of W. K. Hanna as manager of its Pittsburgh territory, which includes Western Pennsylvania and certain areas in Maryland, Virginia, West Virginia and Kentucky.

Horace E. Thorn has been made manager of the Philadelphia branch office.

The Wiremold Company, Hartford, Conn., is now using its new 30,000 sq.ft. addition to the plant.

Cutler-Hammer, Inc., announces the appointment of B. H. Chamberlain to the Los Angeles sales staff. He was formerly in the Detroit office.

At a meeting of the Board of Directors of Hygrade Sylvania Corp., Walter E. Poor was elected executive vice-president in charge of all operations of the company. Mr. Poor will make his headquarters at the New York City offices, located at 500 Fifth Avenue.

Brown Company has moved its main office to Berlin, N. H. H. P. Carruth, general manager, will be at Berlin, as will all departments of the company except the sales department. The General Sales Offices are at 500 Fifth Avenue, New York, N. Y.

Sterling Electric Motors, Inc., has opened a New York office at 11 West 42d Street. Allen A. Adams, eastern manager, will make this office his head-quarters.

National Carbon Company, Inc., has appointed John M. Spangler as general sales manager. He has been with this company since 1915.

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## Voltage Tester

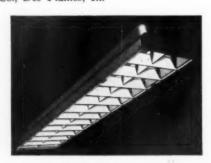
Catalog No. 5000 voltage tester indicates voltage by position of pointer in relation to a graduated scale. The use of different colored bands for each a.c. voltage, together with increased travel of pointer at higher voltages, makes possible easier readings. A.c. is distinguished from d.c. by vibration of pointer. Rubber-covered lead wires are fitted with hooks and sharp points for piercing wire insulation without damage. Square D Company, 6060 Rivard St., Detroit, Mich.



SQUARE D VOLTAGE TESTER

## Lamp-Shielding Louver

New lamp-shielding louver for "Stream-Liter" fluorescent fixtures has been developed. It increases shielding angle to approximately 23° in all directions. Louvers are steel, designed in "egg-crate" construction and finished in white enamel. Two spring clamps on each side rail snap over reflector bead to secure louvers in position. Available for both twin-lamp and triple-lamp. Benjamin Electric Mfg. Co., Des Plaines, Ill.



BENJAMIN LOUVER



CRAMER INTERVAL TIMER

#### Timer

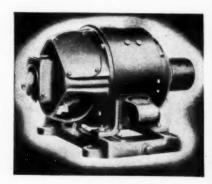
This model D2 interval timer is designed for the control of industrial equipment which can be automatically timed. A standard self-starting synchronous motor driven interval timer is enclosed in a dust tight and splash proof aluminum housing arranged for conduit connection and provided with full vision window and external setting knob. Available in 12 different scales, ranging from one revolution in 15 seconds to one revolution in 24 hours. R. W. Cramer Company, Inc., Centerbrook, Conn.



OHIO BURNISHER

#### **Burnishing Tool**

A new burnishing tool for rings and commutators has been developed. It hones commutator to a fine degree and keeps it that way with periodical application. Hold burnisher firmly against commutator until film or glaze is removed. It will not reduce high mica, flat or burned spots. Available in six sizes for use with commutators from 1½-in. long to 20-in. long. The Ohio Carbon Company, 12508 Berea Road, Cleveland, Ohio.



G-E. MOTORS

## Motors

A new line of d.c. motors has been developed. New design of rolled-steel frame and improvements in end-shield and bearing-bracket construction give protection from external damage. Use of Formex wire coils and a Glyptal insulating varnish provide high resistance to impact, abrasion and action of foreign materials. Can be furnished with sleeve or ball bearings. Open motors are available in constantspeed ratings from 1 hp. at 850 rpm. up to and including 60 hp. at 1750 rpm. Adjustable-speed ratings from ½ hp. at 850/3400 rpm. up to and including 15 hp. at 500/1800 rpm. V-type double-brushholders permit rotation in either direction and a new type lifting lug facilitates handling. General Electric Co., Schenectady, N. Y.

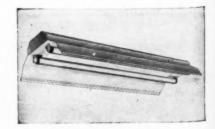
## **Lighting Fixture**

This twin lamp open end fluorescent luminaire has been designed for general or supplementary continuous strip lighting in low bay industrial areas. These type FPC units are available only in two lamp spread distribution style and use two 40-watt, 48-in. fluorescent lamps. Units consist of hood, reflector, lampholders, lamp starters, and ball as equipment. Twin ballast units and compensators provide high power factor of 95-99 per cent. Arranged for rigid or flexible conduit, or chain suspension mounting. For continuous strip lighting, special end connecting bushings are furnished. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

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WESTINGHOUSE LUMINAIRE



# New savings mean more sales of G-E MAZDA FLUORESCENT LAMPS

LVERY day the story of G-E MAZDA Fluorescent lamps grows more amazing. So swift has been the acceptance of this new, cooler, high-efficiency light source—so wide-spread has become its use throughout industry—so steady has been the development of new G-E manufacturing economies—that again General Electric announces lower prices. Again General Electric passes its savings along to your customers.

Now fluorescent light costs less than ever before. You can sell more of it—to help speed production, step up sales, cut errors. You can install "windows of day-

light" everywhere—better work with less eyestrain—daytime morale on the night shift! You can provide the new higher levels of light needed to keep your customers forging ahead on today's increased production schedules.

General Electric offers electrical wholesalers a wealth of sales helps and direct mail pieces to send to stores, factories, offices, and other business prospects for "F" lighting. See your nearest G-E Lamp Sales Office, or write General Electric Co., Dept. 166-EC-A, Nela Park, Cleveland, O.

# Before you sell any type of FLUORESCENT LIGHTING ask yourself these questions:

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1941

1 Are you stocking a wide enough choice of fixtures so that you can meet your customers' individual lighting needs?

2 Is the performance of the fixtures and ballasts and starters certified for best lighting results by Electrical Testing Laboratories?

3 Are you selling G-E MAZDA Fluorescent Lamps, which give all the efficiencies and economies of MAZDA Research?

## NEW LOW PRICES ON G-E MAZDA "F" LAMPS

15-watt T-8 (daylight or white†) . . . was 95c . NOW 85c 20-watt T-12 (daylight or white†) . . . was \$1.25 . NOW \$1.10 30-watt T-8 (daylight or white†) . . . was \$1.25 . NOW \$1.10 40-watt T-12 (daylight or white†) . . . was \$1.90 . NOW \$1.60 100-watt T-17 (daylight or white†) . . . was \$3.75 . NOW \$3.50 (recently introduced)

Prices also reduced on colored G-E MAZDA "F" Lamps † Standard white (3500°K)

# G-E MAZDA LAMPS GENERAL @ ELECTRIC

## GENERAL ELECTRIC Wiring Devices for Industry

A FEW OF THE MANY DEVICES AVAILABLE



GE1166 socket, one-piece body—for Mogul base lamps



GE3329 weatherproof socket—for damp locations



GE2703 Textolite socket—strong where strain comes



GE2971 heavy-duty switch, 20 amp. type



GE2777 four-pole outlet and GE2775 cap, 20 amps., 250 volts







GE3094 three-wire body and GE3080 cap

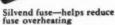




GE857 ceiling switch for lighting



GE2268 and GE3239 cable ter-



You'll find the heavy-duty wiring devices you need for industrial wiring in the G-E line-sockets, switches, outlets, connectors, extenders, fuses, etc. The quality of these devices is uniformly high. They give lasting, dependable service. G-E distributors are located at key points all over the country to care for your individual

For further information see the nearest G-E Merchandise Distributor or write to Section D-181, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

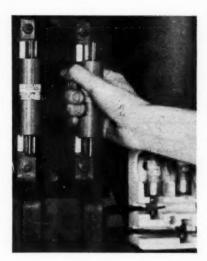
GENERAL ELECTRIC



[FROM PAGE 88]

## Cartridge Fuses

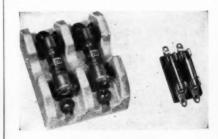
This new line of "Shock-Proof" cartridge fuses features a casing of hard fibre over the entire body of the fuse, eliminating the metal and ferrules and permitting removal of the fuse without fuse pullers and the possibility of shock. Simplified construction features only two parts, the casing and knife blade, besides the renewable link. A twist readily disengages these parts for link renewals. Approved by Un-derwriters Laboratories. Available in 250 or 600 volts, up to 600 amperes in size. Warren Lamp Co., Warren, Pa.



SOLAR SHOCK-PROOF FUSE

#### Fuses

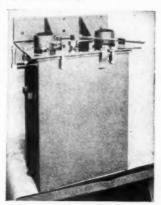
Underwriters approved 3-AG glass enclosed fuses in ratings up to 8 amperes for 250-volt a.c. or d.c. service or less are now being manufactured. Recommended for use with electric appliances, heavy duty power supplies, amplifiers, ra-dio, motors. "Sleeve type" 3-AG fuses, 4 to 8 amps., have separate glass sleeve over entire fuse element that takes pressure shocks under short circuits. Space savings are now possible. Littelfuse In-corporated, 4757 Ravenswood Avenue, Chicago, Ill.



LITTELFUSE FUSES

### Switch

A new oil-immersed disconnecting switch, SF-1, has been developed. It is available as an enclosed triple-pole, single-throw, group-operated disconnecting switch in the 5000-volt, 600 ampere rating. It is for use indoors or outdoors as an isolating device for oil circuit breakers or motor starters. All terminals and connections are at least six inches under oil, and double-break contacts are used. Operating lever, which may be locked either open or closed, gives positive indication of switch position. An interlock bar on tank prevents removal of tank with switch closed or line side of switch energized. Oil gage is weatherproof. General Electric Co., Schenectady, N. Y.



G-E DISCONNECTING SWITCH

## **Sound System**

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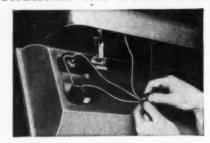
A new, specially designed Teletalk system for lunch counters to facilitate customer service, save steps and time. Consists of microphone, amplifier and speaker to provide instantaneous one-way communication between counter and kitchen. Can be enlarged to six microphones and four speakers on one amplifier. Microphone has mounting clamp, push button, red and green pilot lights to indicate when system is in use and request for repeat instructions. Amplifier has on-off switch, pilot light and volume control. Moisture and steamproof speaker is for ceiling or wall mounting. Webster Electric Company, Racine, Wis.



WEBSTER COUNTER TELETALK



#### STANDARD THE WORLD OVER!



#### Ideal for Fluorescent Wiring

- Solderless, Tapeless Wire Connectors.

  Just strip wires, screw on—that's all!

  No solder, no heat, no open flame hazard.

  Better electrically—stronger mechanically.

  Make craftsmanlike job—no messy joints.

  Sizes for all common wire joints.

  Fully approved: Listed by Underwriters' Laboratories, Inc.

  Safer. Pass inspection quickly.

#### **MILLIONS IN USE!**



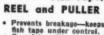
IDEAL TEST GLOW

SAFE!—Tests electrical and radio circuits, motors, fuses, etc. from 80 to 550 volts A.C. or D.C.



IDEAL "HANDY"





h tape under control. emplete with 50 ft. of "x .045" tape. PRICE-Only \$1.50



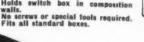
BX ARMOR CUTTER

- Cuts armor from 2 or 3 wire No. 12 or No. 14 BX in one operation.
- No more nicked insulation, shorts or wasted BX.
- Pocket size. Inexpensive.



"Snap-Tite" Switch Box SUPPORTS

- Holds switch box in composition





#### IDEAL JOIST BORING MACHINE

- · Easily assembled.
- Bores at any angle through joists, rafters, etc.
- No climbing—no stooping—no straining.
- Works II ft. above or below floor level.

Electrical Products Division

SOLD THROUGH JOBBERS

COMMUTATOR IDEAL DRESSER CO.

Sycamore, Illinois 1041 Park Avenue Sycamore, Illino
"SALES OFFICES IN ALL PRINCIPAL CITIES"



[FROM PAGE 91]

#### Connector

A new type of connector for conduits and tubing has been developed. Some of the features are-connector construction of sheet steel; larger shoulder, com-pletely closing knockout hole in box; improved bonding-type lock nut. It is claimed that time-wasting splitting of tube ends is now impossible. Briegel Method Tool Co., Galva, Illinois.



BRIEGEL CONNECTOR

### Clocks

Two new synchronous program clocks for operating time signals have been developed. Type P 512 will operate a signal at any five-minute period and Type PD 124 will operate at any one-minute period. Clocks have large 24-hour dial and a onehour dial cam. Pointers, connected to a contact arm, ride the dials and permit contact arm to fall only when preset time is reached. Contact can be so arranged as to operate a signal either in one ring or a coded ring, or for a definite duration of time, from 2 to 6 seconds. Units are enclosed in dust-proof case. Zenith Electric Co., 845 South Wabash Ave., Chicago,



ZENITH CLOCK

## (FEATURES MODELS PRICES

A COMPLETE NEW LINE OF

## "AUTOMATIC" TIME SWITCHES

## For Your Profit

## Here Are A Few **NEW MODELS..NEW PRICES**

- 45 Amperes... Double Pole... \$20.00
- 45 Amperes...Single Pole... \$18.00
- 30 Amperes...Double Pole... \$15.00
- 30 Amperes...Single Pole... \$13.00 20 Amperes...Single Pole... \$12.00

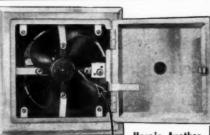
## Portable, Plug-in Models

- 10 Amperes...Single Pole... \$11.50
- 7 Amperes...\$10.50

## Write For Information

## AUTOMATIC

Electric Manufacturing Co. MINNESOTA MANKATO



Here's Another

## IMPORTANT FEATURE

This feature now found on all Signal Wall Box Vent Fans

Now to stop the motor or to remove it for cleaning requires only to pull the plug in the switch box. Other superior characteristics include quiet type fan blades, enclosed motor with large wool-packed oil reservoir and high air delivery. Write for literature and prices.

## SIGNAL ELECTRIC MFG. CO.

MENOMINEE, MICHIGAN Offices in all principal cities



## Switch

A new line of 100 ampere pull-out type service control has been developed. It is available with or without branch circuits, the 100 ampere pull-out type being rated at 230-volts, a.c. Also available with two 60 ampere pull-outs; and 4, 6 or 8 plug fuse circuits rated 115/250-volts. Some of the features are dead-front construction; Bakelite switch base; 3-wire grounded solid neutral; new type solderless lugs on all 60 and 100 ampere terminals; fuse testing facilities; plenty of wiring space. Device comes in surface or flush mounting types. Cutler-Hammer, Inc., Milwaukee, Wis.



CUTLER-HAMMER SWITCH

## **Cutout Connectors**

d

The new Shur-Grip pressure connectors are an integral part of the cutout base on all Shawmut cartridge cutouts. These new connectors are compact, easy to wire and feature positive electrical connection. They are composed of two clamping plates fitted with gripping teeth and a twin bolt construction to give maximum clamping pressure and eliminate possibility of loosening or heating. Connectors do not extend beyond the cutout base and take a minimum of wiring space. Furnished as standard equipment on all cartridge cutouts above 30 amperes. The Chase-Shawmut Company, Newburyport, Mass.



SHAWMUT CUTOUT

FROM WHAT I'VE SEEN,
THE BETTER THE FITTINGS
THAT GO INTO A JOB, THE
BETTER THE REPUTATION
THAT COMES OUT OF IT

## CONDULETS

Condulets are the "stand-out" line of conduit fittings because they're the line that stands up in service. When you're wiring a plant for uninterrupted service, it's easy for you to demonstrate that they have an importance all out of proportion to their cost. Crouse-Hinds has been building them for long-run satisfaction since 1906.

Condulets assure a rigid joint with permanent ground continuity. They eliminate troublesome "almost-fits" and weak joints that vibration may afterward shake loose. They make a neat, clean job of conduit wiring from start to finish. Because there are over 15,000 types of Condulets, you're sure of meeting every angle of every job with exactly what's required. They keep paying you dividends in the form of "reputation insurance" years after the contract is completed.

## **CONDULETS... first because of these features**



Condulets are just one of the top-quality lines of wiring supplies you get when you put your requirements up to GRAYBAR. What's more, GRAYBAR stocks help assure prompt service on exactly the type and grade of item you want; there's a lot less occasion for buying things that are "almost" what's wanted, just to save time in an emergency.

Write GRAYBAR for full details on Condulet features, or any other wiring supply requirement!

OFFICES IN OVER 80 PRINCIPAL CITIES

Executive Offices: Graybar Building, N. Y. C.





Penn-Union makes ALL good types. A complete line of clamps, studs and connectors for all applica-tions. For all combinations of pipe, rod, flat bar, cable, braid,



Also the most complete line of Service Connectors, Cable Taps, Terminal Lugs, Tees, and other fittings. Penn-Union is the choice of leading utilities and industrials, contractors, and manufac-turers of electrical equipment.

> Sold by Leading Jobbers Write for Catalog

PENN-UNION **ELECTRIC CORPORATION** ERIE, PA.





**IFROM PAGE 931** 

## **Lighting Fixtures**

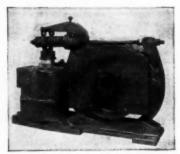
A new "EV" series of explosion-proof lighting fixtures, which comply with requirements of Class 1, Groups C and D, hazardous locations, has been developed. The sectionalized type of fixture construction permits easy and rapid installation, it is claimed. Some of the features are connection block, shock-absorbing socket, inner reflector, Pyrex globe, and cast Duraluminum guard. Relamping is done by loosening thumb screw and removing globe holding assembly. Appleton Electric Company, 1701 Wellington Ave., Chicago, Ill.



APPLETON LIGHTING FIXTURE

## Magnetic Brake

A magnetic brake capable of withstanding salt water action in marine service has been added to this line of standard industrial d.c. magnetic brake. Although designed primarily for marine service, it may be used in other applications when a water tight brake is required. It is known as Type DW marine brake, and is available for operation on 115 and 230-volt d.c., with continuous duty torque ranges from 15 to 1350 poundfeet. Shunt coils are standard and low voltage coil and series resistor are used to obtain fast operation. Metal shields cover brake wheel and house operating coil. Watertight enclosures for entire brake are also available. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.



WESTINGHOUSE MAGNETIC BRAKE

## Just off the press! THE NEW NATIONAL ELECTRICAL CODE HANDBOOK

COVERING THE NEW 1940 CODE

ATTONAL

CODE

ANDBOOK

IMPORTANT

NOTE

The new 1940 Code

Code contains more changes

than any previ-ous Code, and the new ABBOTT

covers fully every item of

this new Code.

CTRICAL

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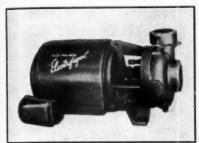
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## Pump

"Electrifugal" pump is an all-in-one centrifugal pump designed as a complete pump and motor unit on one shaft and one housing. It has one piece cast iron motor yoke and pump bracket. Motor design meets NEMA specifications for splash proof motors. Totally enclosed, fan cooled motors and explosion proof motors are also available in this type. Available in sizes from 1 hp. to 10 hp. incl. at 3500 rpm.; 4 hp. to 7½ hp. incl. at 1750 rpm. Allis-Chalmers Mfg. Co., Milwaukee, Wis.



ALLIS-CHALMERS PUMP

## Lampholder

These new devices were developed for the 4 and 6 watt fluorescent lamps which were designed especially for business machines, berth lights, cabinet lighting, portrait lighting. There are two identical lampholders, one being right hand and the other being left hand as far as position of contacts is concerned. Bryant Electric Company, Bridgeport, Conn.



BRYANT MIDGET DEVICES

#### **Fitting**

five 210.

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1941

An outdoor receptacle fitting has been added to this line of weathertight conduit fittings, for use in rural electrification wiring. It is made in two types with one hub or straight through with two hubs, complete with 15 amp. 125-volt or 10 amp. 250-volt receptacle. It also has lift cover. It will take standard attachment plug caps. Appleton Electric Company, 1701 Wellington Ave., Chicago, Ill.



APPLETON FITTING

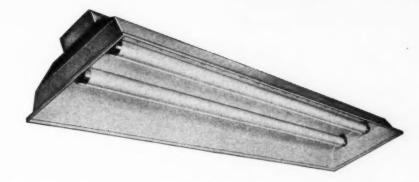
## For Higher Levels of Illumination



TWO NEW TWIN-LAMP

Every Wheeler RLM Fluorescent Unit hears the RLM Label which guarantees its authenticity and performance.

## L M FLUORESCENT UNITS For the New 60", 100-Watt Type F Lamps



These new Wheeler RLM Fluorescent Lighting Units are designed and manufactured to conform with the rigid specifications established by the RLM Standards Institute. Units are available in the following styles:

- 1. A standard RLM Unit, without apertures.
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These larger size Fluorescent units, when installed at the conventional 10' spacing and mounting heights, furnish the higher levels of illumination so essential to many manufacturing requirements. Also, in locations where the ceilings are higher than average these new units will provide adequate levels of illumination.

RLM Units are recommended for use with the new 3500° K White Fluorescent Lamp, and can be used in any industrial locations where efficient high level illumination in required. They are extremely efficient, cooler in operation, easily installed, and easily serviced. The units, which employ two 100 watt, 60" Fluorescent Lamps are supplied complete with high power factor Tulamp ballasts for either 110-125 volt, 199-216 volt, or 220-250 volt operation. All units are supplied complete with Mogul Bipin Twist-turn lamp holders and removable starter switches.

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Unit features:

Shielding angle of 14 degrees.

Porcelain Enamel reflecting surface with reflection factor of 79%.

Light output efficiency of 75%.

Corrected for power factor and flicker.

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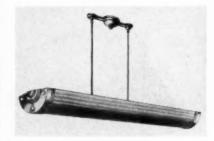


[FROM PAGE 95]

## **Fluorescent Fixtures**

With these new fluorescent fixtures it is claimed that installation and maintenance costs are reduced. Series L 144-48 utilizes four fluorescent lamps and is available in both 40 watt and 20 watt sizes.

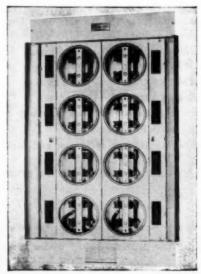
A shielding cylinder of reeded satin etched glass is used. Exterior and canopy are finished in aluminum. Reflecting surfaces are baked white enamel. Lamps are so arranged that a portion of light is directed toward ceiling. Trenton, N. J. Efcolite Corporation,



EFCOLITE FIXTURES

## Meter Channel

These circuit breaker meter channels have been developed for use in resi-dential and some commercial buildings. Channels house socket type meters and circuit breakers to provide positive short circuit and overload protection. Indoor units may be flush or surface mounted. Outdoor units are provided with raintight cover. Channels are made to meet all electrical and dimension requirements. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.



WESTINGHOUSE METER CHANNEL

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Conduit 3/8"-21/2" Cable to 21/8" (with Bushings)

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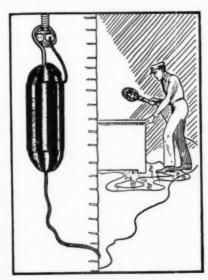
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RELIANCE AUTOMATIC LIGHTING COMPANY 1937 MEAD STREET RAGINE, WISCONSIN

## **Transformer**

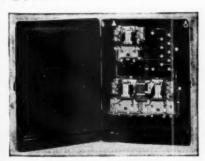
This transformer, called Safety Tran, is designed to reduce deaths and accidents that occur in handling electric extension cords in wet and damp places. A small cylindrical device. Case is said to be water and moisture tight. A hook is provided on one end to carry and hang it where convenient. To use, plug one set of wires in any 110 or 115-volt receptacle, hang device by hook on BX receptacle. To other end of transformer the light extension cord is attached. It reduces any 110 or 115-volt current down to 6-volts. The Newark Transformer Co.



NEWARM-SAFETY TRAN

## **Magnetic Starters**

A new line of across-the-line magnetic starters have been developed. These are for use with multi-speed squirrel cage motors of from 220- to 600-volts, 1 to 100 hp. Different speeds are obtained by changing connections to motor so as to change its number of poles. Starters are available for following types of multi-speed motors in 2, 3 or 4 speed types-constant horsepower; constant torque; torque; single winding motors; double winding motors. Features include pushbutton speed selection, overload protection, low voltage protection, "De-Ion" arc quenchers, and front of board wiring with accessible terminals. All sizes available in standard or dust-tight sheet steel enclosures. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.



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SIN

1941

WESTINGHOUSE STARTERS

# "RAGGED ARMIES" (of electrical control equipment) CAN'T WIN EXPANSION

**But**, look at these pictures of NEW Trumbull Motor Control Centers . . . standardized units that put together just like a kid's building blocks.

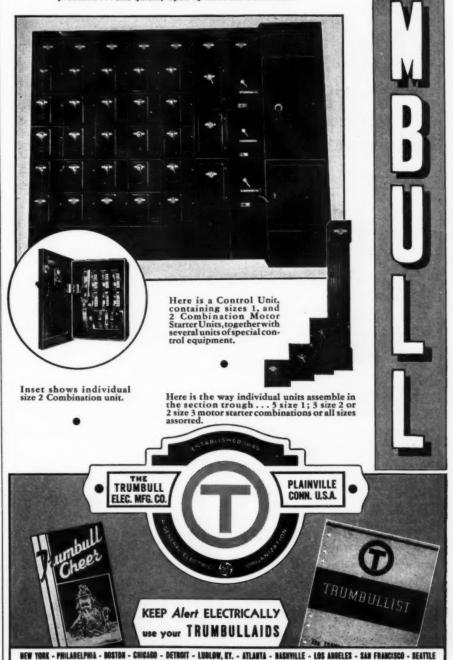
TIME-SAVINGS in ordering . . . installation . . . wiring and hook-up to machines.

SPACE SAVINGS, with trim, efficient, centralized control units, instead of a "ragged army" of unrelated equipment. Push - buttons, of course, for remote control from operating stations . . . perfect set-up for multi-motor machines.

FLEXIBILITY when you have to expand(or contract), relocate or change-over. Control units can be re-grouped in sections or sections re-grouped in the plant.

And think of the EASE of ordering these completely standardized control units for rapid installation.

Equipment like this will help solve your defense speed-up problems . . . and quickly open up electrical bottlenecks.



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JAWS that grip like a vise—knives that shear through the toughest wire —handles with just the right spring for comfort—that's Klein pliers!

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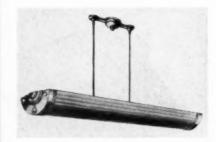




FROM PAGE 95]

#### Fluorescent Fixtures

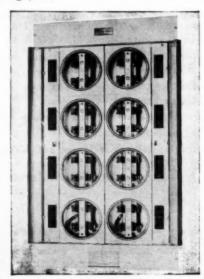
With these new fluorescent fixtures it is claimed that installation and maintenance costs are reduced. Series L 144-48 utilizes four fluorescent lamps and is available in both 40 watt and 20 watt sizes. A shielding cylinder of reeded satin etched glass is used. Exterior and canopy are finished in aluminum. Reflecting surfaces are baked white enamel. Lamps are so arranged that a portion of light is directed toward ceiling. Efcolite Corporation, Trenton, N. J.



EFCOLITE FIXTURES

#### Meter Channel

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WESTINGHOUSE METER CHANNEL

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Cable to 21/8" (with Bushings)

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## BADGER

Synchronous ELECTRIC TIME SWITCHES



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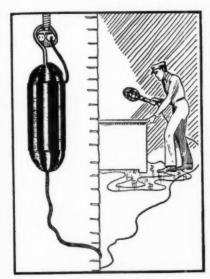
USERS LIKE THEM BECAUSE:
of economical operation and low cost

The Badger line of Time Switches is always in demand by Contractors who want dependability, accuracy, and the right type for a specific need. They know from experience that this is the line that gives them successful, profitable installations. They know when they install Badger Synchronous Electric Time Switches for their customers they are giving them complete satisfaction—accurate timing, economical operation, dependable service. You can't go wrong on Badger. Write for more particulars or see your Wholesaler.

RELIANCE AUTOMATIC LIGHTING COMPANY 1937 MEAD STREET RACINE, WISCONSIN

### **Transformer**

This transformer, called Safety Tran, is designed to reduce deaths and accidents that occur in handling electric extension cords in wet and damp places. A small cylindrical device. Case is said to be water and moisture tight. A hook is provided on one end to carry and hang it where convenient. To use, plug one set of wires in any 110 or 115-volt receptacle, hang device by hook on BX receptacle. To other end of transformer the light extension cord is attached. It reduces any 110 or 115-volt current down to 6-volts. The Newark Transformer Co.



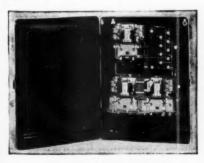
NEWARK SAFETY TRAN

## **Magnetic Starters**

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1941

A new line of across-the-line magnetic starters have been developed. These are for use with multi-speed squirrel cage motors of from 220- to 600-volts, 1 to 100 hp. Different speeds are obtained by changing connections to motor so as to change its number of poles. Starters are available for following types of multi-speed motors in 2, 3 or 4 speed types-constant horsepower; constant torque; variable torque; single winding motors; double winding motors. Features include pushbutton speed selection, overload protection, low voltage protection, "De-Ion" arc quenchers, and front of board wiring with accessible terminals. All sizes available in standard or dust-tight sheet steel enclosures. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.



WESTINGHOUSE STARTERS

# "RAGGED ARMIES" (of electrical control equipment) CAN'T WIN EXPANSION

**But**, look at these pictures of NEW Trumbull Motor Control Centers . . . standardized units that put together just like a kid's building blocks.

TIME-SAVINGS in ordering . . . installation . . . wiring and hook-up to machines.

SPACE SAVINGS, with trim, efficient, centralized control units, instead of a "ragged army" of unrelated equipment. Push-buttons, of course, for remote control from operating stations . . . perfect set-up for multi-motor machines.

FLEXIBILITY when you have to expand (or contract), relocate or change-over. Control units can be re-grouped in sections or sections re-grouped in the plant.

And think of the EASE of ordering these completely standardized control units for rapid installation.

Equipment like this will help solve your defense speed-up problems . . . and quickly open up electrical bottlenecks.



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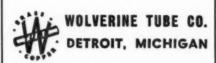
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Acme engineers have co-operated with the research engineers of leading fixture and lamp manufacturers from the very inception of fluorescent lamps. The experience thus gained naturally has led to design innovations in Acme Fluorescent Ballast units that assure long-life, humless, trouble-free performance.

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THE ACME ELECTRIC & MFG. CO. 36 WATER STREET - CUBA, NEW YORK

cmo (M) tectric



[FROM PAGE 97]

#### Switch

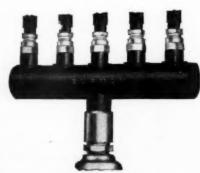
A new type main circuit crane safety limit stop, to prevent overtravel of crane hook when hoisting, has been developed. It operates by means of a counter weighted lever and a suspended reset weight. Taps are provided in resistor to adjust braking. When limit stop is in tripped position, a by-pass circuit is established which permits backing out of limit at slow speed. Among the features are quick make and quick break tripping mechanism; enclosed case withstands rain, snow, ice and dirt; neoprene gasket makes switch waterproof for outdoor installations; limit stop may be mounted in any of four quadrants. Rating is 100 hp. at 230-volts d.c. Cutler-Hammer, Inc., Milwaukee, Wis.



CUTLER-HAMMER SWITCH

#### Stud Connector

This insulated stud connector, Type ZMDZ, has been designed for joining several cables to smooth or threaded stud. Cables are gripped by compression cone clamping elements. Stud is gripped by compression cone, threaded to screw onto Insulation of connector is comstud. pleted by taping exposed metal parts or insulating sleeves can be furnished. It can be used in underground distribution systems, at network protectors or on secondary terminals of underground transformers. Burndy Engineering Co., Inc., 459 East 133d Street, New York, N. Y.



BURNDY STUD CONNECTOR

Every phase of electrical maintenance and repair work covered in this NEW Library



Every man concerned with the care and repair of electrical machinery should have these practical books, with their helpful tables, diagrams, data, methods and kinks. Every one of the five volumes is jammed to the covers with sound, how-to-do-it information-the kind you have to have when anything goes wrong. Liberal use has been made of practical data and practice in repair shops so as to combine the good features of a library of methods with handbook information covering these methods.

## Electrical Maintenance and Repair Library

2042 pages, 1721 illustrations and diagrams

These books show you how to

- -install all types of motor and generator
- Install all types of motor and generator units;
  locate breaks in armature windings and do a workmanijke job of rewinding;
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  make accurate tests of switchboards and apparatus and correctly balance the power with the load;
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Now, in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's Troubles of Slectrical Equipment, a new book full of helpful maintenance information, special trouble-shooting charts, explanation of symptoms and causes of machinery troubles, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

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## **Lighting Unit**

This "50 Foot Candler" gives continuous fluorescent lighting for general illumination. Available in either single or double length wiring channels for two or three 40-watt lamps. Units may be run in continuous line suspended by chain, wire, rod or conduit, or close up to ceiling. Multiple knockouts provided at top of channel for different size cables. Each length of wiring channel to which reflectors attach, is wired with operating auxiliaries, sockets, etc. The Miller Co., Meriden, Conn.



MILLER "50 FOOT CANDLER"

## Attachment Plug

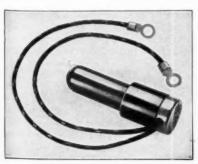
A new Receptaplug for non-carpeted floors or rugs has been developed. It is for use where 290 floor tread is used beneath floor covering and can be reached to change its position. Receptacle mortises into floor. Rubber capped plug is inserted flush into it leaving no bulge. Plug will not fit standard lighting receptacles, thus preventing the possibility of shorting lighting line. Receptaplug is furnished without cord and floor push. Edwards and Company, Norwalk, Conn.



EDWARD RECEPTAPLUG

## **Mercury Switch**

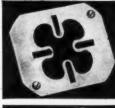
Two new unbreakable mercury switches, Nos. A-5M and A-10Z, have been developed. Both have new internal construction characteristics that enable them to carry greater currents than regular Durakool switches with same dimensions, it is claimed. A-5M has a small required angular tilt for operation and maintains it under heavy overload. Also adapted to snap acting mechanisms, as well as tilt action. Durakool, Inc., Elkhart, Indiana.



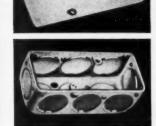
DURAKOOL MERCURY SWITCH

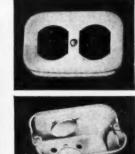
# G-E MULTILETS

The Conduit Boxes with a Thousand Uses









Shallow Multilet and Typical Cover

Designed to accommodate surface-type wiring devices. Can also be used for same purposes as Branch Multilet.

Branch Multilet and Typical Cover

Designed for branches, junctions, pull work or extensions.

Deep Multilet and Typical Cover

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Multilets, formerly called Spraguelets, have been proving their worth for 20 years. You don't need a large stock of conduit boxes for interior work. Use Multilets in any one of a thousand ways for exposed wiring in rigid conduit or E.M.T., for concealed wiring, and for BX or flexible conduit wiring.

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other support necessary or they may be used as ordinary outlet boxes.

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General Electric Company Section C-181, Appliance and Merchan dise Department Bridgeport, Connecticut
Sirs: Please send me information on G-I Multilets.

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■ WE PRESENT the Smithcraft Industrial Unit . . . especially designed to combine maximum good lighting and maximum lighting efficiency with minimum cost . . . for factory, showroom and mill installations. Simplicity of appearance and maximum utility combine to give years of better, more practical lighting service.

Body of unit comes in either bronze or aluminum; reflector is in baked white enamel. Wired with "Tulamp" ballast for high power factor correction and "stroboscopic flicker" elimination. Fully grounded, and bears label of approval of Underwriters' Laboratories, Inc. Lists for \$18.95.

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• For tightening fuse contact with fuse clips.

Prevents fuse failures and charring of fuse casings—that result from terminal heating.

MONARCH FUSE CO., INC. JAMESTOWN, N. Y.

1909 - Established - 1909

EQUIPMENT News

[FROM PAGE 99]

## **Receptacle and Plugs**

The "ESH" series of explosion-proof sealed hospital receptacles is designed for use in hospital operating rooms. All wire leads are sealed and connections made in Unilet body. Adjustments for surface mounting is provided by an adjustable sleeve in Unilet. Receptacle member is a sealed unit with an inter-locking switch, whereby plug may be inserted or withdrawn only when switch is in "off" position. Rating is a.c., 2-wire, 3-pole, 10-amp., 125-volt; ½ hp. 115-volt. Appleton Electric Co., 1701 Wellington Avenue, Chicago, III.



APPLETON RECEPTACLE



G-E GERMICIDAL LAMP

### **Germicidal Lamp**

A new yard-long 30-watt germicidal lamp designed to kill air-borne bacteria. It is a clear glass tube 1-inch in diameter. It uses one transformer and is equipped with medium bipin base at each end. This ultraviolet emitting source kills bacteria because it generates invisible rays somewhat shorter in length than the shortest found in summer sunlight at earth levels. Recommended for use wherever people are massed indoors. Tubes will kill bacteria only on those areas subjected to the lethal radiation. General Electric Lamp Department, Nela Park, Cleveland, Ohio.

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## NEW 100-WATT FLUORESCENT LAMP

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Each lug fits several wire sizes. Full line ranges from No. 1 to 2,000,000 C.M. Catalog No. 3LC shows this and a full line of Solderless Lugs and Connectors of all types.

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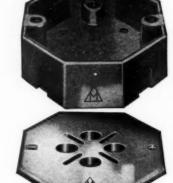


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Contractors who use these products not only establish themselves most securely with their customers but also build their business by making each job a true quality one. Send for builetin.

ILLINOIS ELECTRIC PORCELAIN CO.



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### **Push Button**

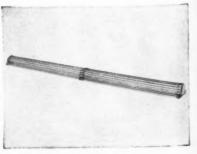
This new illuminated Bakelite push button eliminates hunting for house numbers at night. It is recommended for private homes, doctors, dentists, lawyers or individual apartment doors. It has provision for illuminating name, house number and push button. Name and house number are written on translucent plate by owner. Small lamp inside illuminates plate and push button. Operates on all bells and chimes from 6- to 14-volts. Also available in higher voltages. It measures 3\frac{3}{4}-in. by 1\frac{1}{4}-in. Eagle Electric Mfg. Co., Inc., 59 Hall Street, Brooklyn, N. Y.



EAGALITE BUTTON

## Luminaires

A new line of surface-mounting fluorescent luminaires for commercial interiors, designed for single or continuous strip illumination. Two styles are available, both for direct lighting, single lamp and two lamp units. Both use 40 watt, 48-inch white or daylight fluorescent lamps. Units consist of ornamental steel runner, end caps, reflector, ballast, starting switch, sockets, wire and glassware. Glass sections are "Alvax", although translucent, has sufficient opalescence to conceal lamp. For continuous strip requirement, standard single or double lamp extensions are available. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.



WESTINGHOUSE LUMINAIRES

## Washers

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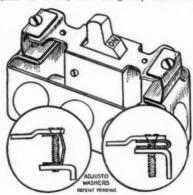
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The new adjusto washers are used for mounting all types of switches and receptacles using the regular screws. They hold the switch or receptacle in a straight and rigid position, and due to their construction keep the screw locked all the way down. Amco Mfg. Co., 2526 San Fernando Road, Los Angeles, California.



AMCO ADJUSTO WASHER

## **Conduit Fittings**

The new Form 37 "Adalets" has smooth curves on the inside of the fittings. The radii of the conduit hub bell-mouth curves are in accordance with the wire manufacturers' performance specification mandrel. The bell mouth curve prevents sharp kinks in wires or cables on all right angle turns, it is claimed. Fittings are made of Adalloy. Available in sizes up to 2 inches. The Adalet Manufacturing Co., 1448 East 49th Street, Cleveland, Ohio.



ADALET CONDUIT FITTINGS

## Motor

A new integral horsepower high torque capacitor motor, Type CJ, from to 3 hp. incl., has been developed. It has necessary capacitors and centrifugal switch mounted within motor brackets. Additional mounting and wiring costs are eliminated. Waste packed sleeve bearings and dual voltage leads are standard and unit is of "protected" type of design. Westinghouse Electric & Manufacturing Co., East Pittsburgh,

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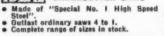
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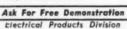


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In Canada: Irving Smith, Ltd., Montreal, Quebec.

Defense Business-Where Is It

[FROM PAGE 17]

industrial states, but all 48 states will contribute raw materials. In a word, it makes a job for the whole nation -this order. And it will take several years to fill.

So there are clearly two phases to this Defense Business-

First, the hectic, high pressure construction in which the Government, after long delay, places orders with large general contractors for huge building projects-arsenals, navy yards, airports, mass housing, factories. Here some of our large electrical contractors, who are organized to handle large operations on a small margin and make money, are already participating. But much of this work is being handled by the general contractors themselves. This is an early, passing phase of this Defense Business. These structures will be soon built. It will mean nothing to the average electrical contractor.

Second, comes the bulk of the Defense Business, which is the purchase by Uncle Sam and by Great Britain of actual war materials. Here an order is placed with a manufacturer for airplanes or tanks or ships or guns or shells or uniforms or foods. The order drops like a stone in the broad pool of American industry and circular waves begin traveling out across the country as these manufacturers place their secondary orders for materials, parts, equipment and accessories. These orders flow to every state. And then in turn, this second line of manufacturers begin to order their raw material and parts. And pretty soon every factory in every city is involved in it.

Then what happens? Management in every factory begins to feel the pressure to speed production and reduce costs and to improve working conditions, so they can hold their labor. And pretty soon comes the construction of additional new buildings, the modernization of old buildings, the introduction of better lighting, more motors, air conditioning, electric furnaces, welding, control and signal-

This business will flow out to the local electrical contractors whose regular customers these local factories are. And this Defense Business will not mean high pressure, fixed fee orders. It will be regular work done in the regular way. We will all be in on it.

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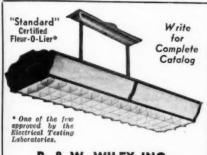
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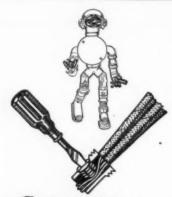
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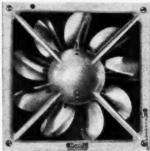
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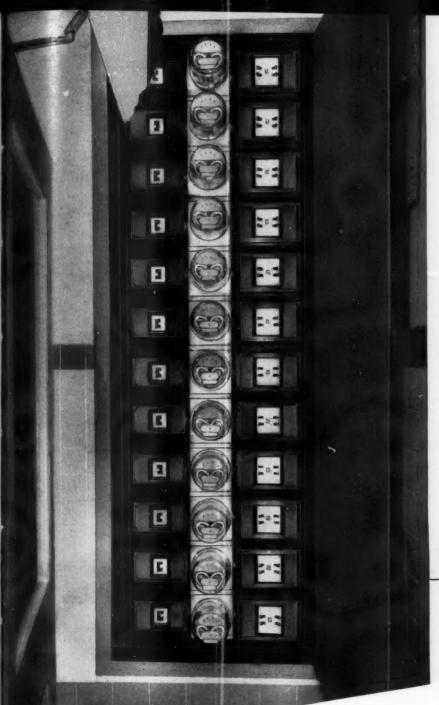
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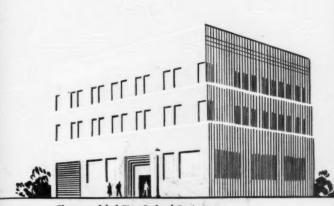
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